MEMORANDUM REPORT

WATER AVAILABILITY IN THE

DADE COUNTY AGRICULTURAL AREAS

RESOURCE PLANNING DEPARTMENT

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INTRODUCTION

The South Dade Agricultural Area is considered as that portion of Dade County south of Tamiami Trail which is devoted to agricultural use (see Figure 1). The western portion of the area called the West Glades Area is characterized for the most part by a highly permeable limestone aquifer overlain by a shallow layer of sand, silt or clay loam. In many locations the rock is broken up to facilitate cultivation and mixed with what soil is available. A large part of the agricultural usage is presently devoted to truck farming. A substantial portion of these truck farms move from one locality to another depending on local conditions and anticipated market rather than being concentrated in a well defined area and cropped on a regular basis.

Irrigation is achieved by utilizing shallow uncased wells with a portable pumping system which moves from well to well. The groundwater is at an average depth of 3 - 4 feet below ground surface at the beginning of the irrigation season. This depth may increase to approximately 8 feet towards the end of a very dry season. Some control over groundwater elevations is achieved by closing control structures at the ridge which separates the West Glades Area from the coastal region when the surface water elevations above these structures fall below operational stages.

The portion of the agricultural area seaward of the ridge is generally called the East Glades Area. Much of this land is rather low with ground surface elevations on the order of 2 to 4 feet msl. The soils in this area are predominately marls and are poorly drained. Irrigation is presently not a common practice in this area but the Agricultural Extension Agent indicates that yields can be increased with judicious use of irrigation water. Groundwater elevations are influenced by gated structures near the coast on project canals.

These structures operate so as to maintain to the extent possible, a dry season water level upstream of the structure of 1.0 feet to 1.2 feet msl and somewhat higher elevations during the wet season.

A procedure is developed which relates rainfall to groundwater elevations. The impact of agricultural usage and the adequacy of the resource for further agricultural development is also analyzed. Recommendations for a water shortage plan are also presented.

GENERAL

A linear multivariate regression model relating change in the groundwater to rainfall and pan evaporation is developed on a monthly and seasonal basis. This model is then used to predict the amount of rainfall, defined here as "maintenance rainfall", required to maintain groundwater storage levels within specified limits. The amount of normal rainfall above the maintenance rainfall yields an estimate of the quantity of water available in a normal year to supplement the natural evapotranspiration process for agricultural purposes and at the same time insure that the water table does not fall so low as to present the danger of salinity intrusion.

A comparision of wet season groundwater stages indicates that operationally desirable water levels are generally reached rather early in the June-October wet season; say before the end of July. Thus, something in the neighborhood of 10 inches in additional rainfall excess is still available to replenish groundwater tables by the end of October, provided sufficient drawdown would have occurred to utilize this excess. Assuming a specific yield from 0.2 to 0.3 $\left(\frac{\text{inch free water}}{\text{inch drawdown}}\right)$, this amounts to the capability of recharging an additional drawdown in the range of four to three feet, respectively, on a "normal year" basis. Since allowing an additional three or four feet of water table drawdown would substantially increase the probability in some areas of salinity intrusion, particularly during drought conditions, it seems more reasonable to base maximum allocations on a minimum groundwater stage rather than on a "safe yield" concept defined analogous to the amount of potential recharge.

The multivariate correlation technique was selected for analysis rather than a water budget approach because of difficulty in reducing surface flow records to a usable form and the strong possibility of a significant imbalance in

groundwater flow into and out of the study areas. It was further felt that surface and groundwater flows should be highly correlated with rainfall and evaporation and thus be reflected in these parameters.

Monthly correlations were developed in the form: (Monthly change in groundwater elevation in inches) = A + B x (Monthly rainfall in inches) + C x (Monthly pan evaporation in inches) where A, B and C are constants whose values are arrived by use of standard correlation procedures. A similar correlation was performed for dry season and wet season values.

One other correlation was performed in order to find the form which best suited the data. This took the form (end of month groundwater elevation (feet msl)) = A + B x (monthly rainfall in inches) + C x (end of previous month groundwater elevation).

Monthly correlations using the first method range from good to poor, with the majority of the dry season correlations rated as fair. Correlation coefficients average 0.52 with a maximum of 0.80 and a minimum of 0.01. The standard error of the estimate of monthly change in groundwater elevation ranges from 1.87 inches to 5.42 inches with a mean of 2.95 inches in the West Glades Area, and from 1.20 inches to 6.36 inches with a mean of 4.15 inches in the East Glades Area. On a dry season basis good correlations are obtained, 0.81 in the western area and 0.92 in the eastern area. The standard error of the estimate for the west area is 9.0 inches and the eastern area 5.4 inches. The correlation coefficients for the lumped wet season are not significantly different from zero in either the west or east area. A possible explanation for this lack of correlation is that optimum levels are maintained by increasing or decreasing project canal discharges to compensate for varying rainfall amounts. Thus, the entire deficit in groundwater storage is satisfied regardless of the amount of rainfall or evaporation (within the range of historical record).

The second method produces much higher correlation coefficients (on the order of 0.90). The standard error of the estimate for groundwater change remains essentially the same. It is found that the monthly correlations based on groundwater stage reduce the maximum cumulative error in predicted stage from nearly 4 feet to 1.2 feet in the western area and from nearly 3 feet to 1.27 feet in the eastern area for a fourteen year test period. This second method was selected for the analysis. Values of the coefficients are presented in Table 7. These relationships could also be used for predicting critical monthly groundwater elevations during drought periods.

LAND USE

The area (see Figure 1 and Figure 2) was subdivided into two regions because criteria for control of surface water stages (and, thus, discharges) varies significantly between the two areas and it was felt this might influence the derived correlations. The boundaries of the two areas were selected on the basis of land use information contained in "1970 Land Use and Highway Functional Classification", DOT, and "Comprehensive Development Master Plan (Dade County) June 1974", Dade County Planning Department. It should be noted that these boundaries do not necessarily delineate either surface or sub-surface drainage basins.

Agricultural land use in the study area is principally truck crops with a substantial amount of fruit trees. There is some improved pasture in the northern part of Dade County which was not considered in the present analysis. The following table lists the approximate acreage planted to truck crops and fruit trees in selected years from 1929 through 1974.

YEARS	ACRES TRUCK	ACRES FRUIT	ACRES TOTAL
1929	15,200	7,300	22,500
1939	18,800	7,000	25,800
1949	23,900	7,500	31,400
1958	-	9,600	-
1965	52,200	10,700	62,900
1966	44,700	10,800	55,500
1967	43,900	11,100	55,000
1968	43,300	11,400	54,700
1969	43,700	11,700	55,400
1970	47,300	11,900	59,200
1971	44,500	11,400	55,900
1972	43,100	11,600	54,700
1973	45,100	11,700	56,800
1974	41,000+	11,800	52,800

The Dade County Agricultural Extension Agent estimates that 80 percent of the fruit trees and 78 percent of the truck crops are currently under irrigation.

It may be noted that the amount of land under cultivation has been relatively constant since the early 1960's. A dramatic increase in acreage planted occurred during the 1950's probably due to improved drainage conditions and the development of better land preparation techniques which allowed development of the West Glades Area.

The primary truck crops are tomatoes, beans, potatoes, and sweet corn. Other truck crops grown include cabbage, squash, okra, strawberries, peppers, cucumbers, calabaza, and boniatos.

The main fruit crops are avocados, limes and mangos. Other fruit crops include papaya, lychee, guava, and other subtropical fruits. Prior to 1960 citrus plantings such as grapefruit, oranges, and tangerines were much more extensive than at the present time.

The cultivated soils are very low in organic matter and thus require frequent applications of fertilizer. Control of drainage and irrigation is also very important for high yields. Thus, a high level farm management is required in this area for effective farm management.

The area planted to fruit trees is generally irrigated with portable large volume guns which pump from numerous shallow uncased wells. Some permanent set sprinkler systems are also in use and drip irrigation systems are presently increasing in popularity.

Only a relatively small portion of the area utilized for truck crop production is located at a permanent site. The remainder is generally leased from the landowner for the planting of one crop. Both the location and the amount of land planted thus varies considerably from year to year. In addition, some

of the land is used for more than one crop during a given year. Irrigation is generally by large portable volume guns which again pump from shallow, uncased, and often temporary groundwater wells.

As in most areas in South Florida, there exists increasing pressure for diversion of agricultural lands to urbanized areas. A "Comprehensive Development Master Plan - July 1974" has been prepared by the Metropolitan Dade County Planning Department. This plan sets forth recommendations for the growth of urban areas and to some extent the future expansion of agricultural acreage by recommending specific environmental conservation and preservation zones. The agricultural areas delineated in the present study were based primarily on information contained in this plan.

BASIC DATA

Rainfall over the area (Table 1 and Table 2) was determined by weighing the monthly values of rainfall on 11 stations using the Thiesen Method. Five of these stations are operated by FCD and are designated by numbers 118, 120, 121, 122 and 124. The remaining six are published by the U.S. Weather Bureau (USWB) and are designated as Royal Palm Ranger Station, Homestead Experiment Station, Perrine, Trail Glades Ranger Station, Miami 12 SSW, and South Miami: 5W. Since most of the FCD stations have a short period of record, the years prior to 1967 were calculated using only USWB records.

Pan evaporation (Table 3) was computed for both areas as the weighted average of the USWB records for Tamiami Trail at 40 mile bend and the Hialeah station.

Groundwater elevations are represented by twelve groundwater wells monitored by the U.S. Geological Survey (USGS). The wells are designated by the symbols: G799, G858, G1362,G757, G1363, G789, G614, F358, G864, G613, G1183, and G860. These values were tabulated as adjusted month-end water surface elevations referred to mean sea level (see Tables 4 a - h). These adjusted values were obtained by visually time averaging the values represented on a continuous strip chart from the middle of the preceding month to the middle of the following month. This was done in order to dampen out random short-term fluctuations not associated with hydrological parameters measured on a monthly basis. Strip charts were not readily available for periods more recent than 1972 so the actual month-end values as tabulated by the USGS were used in place of adjusted month-end values in the more recent years. Equivalent stages for the two areas (Tables 5 and 6) were arrived at by assuming a linear variation between wells.

BASIN YIELD

In order to establish continuity in the permitting process an estimate of the basin yield is derived. Basin yield is defined as the volume of water which can be collected from surface and shallow groundwater sources for irrigation and downstream uses. This definition is consistent with that used in other water use areas. (Memorandum Reports on Surface Water Availability in (1) Lake Istokpoga - Indian Prairie, (2) St. Lucie County, (3) Caloosahatchee Basin, (4) St. Lucie Canal Area). The interpretation of how this quantity is to be estimated, however, is somewhat different in this area.

In other areas the concept that this term was essentially equal to the amount of water that would reach project canals in absence of diversions for irrigation (includes seepage into the canals) allowed the use of surface water discharge records as the basis for the estimate. The underlying premise being that there was or could be developed sufficient storage capacity which could be depleted during periods of high demand and still be replenished by water that is presently being discharged through the drainage system over a sufficiently long period of time. This figure was then adjusted by reserving a specific amount for contingent uses and the maintenance of minimum flows to arrive at the quantity available for the consumptive use of irrigation water. An additional restriction on minimum groundwater and surface water stages was established to protect the resource and the physical integrity of the system on a short term basis.

Due to the unique characteristics of the local shallow water aquifer in this area, a somewhat different approach was taken. The surface storage capacity is limited in this area due to difficulties in constructing viable surface water reservoirs and the close inter-relationship between minimum groundwater stages and salinity intrusion. The basis for the basin yield estimate used in this area

is the storage capacity in the groundwater aquifer between the minimum stage criteria and the normal water elevation at the beginning of the irrigation season.

Since there is a strong possibility of a net groundwater flow into the area it is felt that the yield calculated on the basis of this storage volume should be increased to compensate for the part of this inflow which would normally occur. The seasonal regression relationship between groundwater stages and rainfall described previously should provide a reliable first approximation of the integrated effects of withdrawals for supplemental consumptive use and groundwater flow.

The median "adjusted end-of-October stage" was used as the normal elevation at the beginning of the irrigation season. The average of the minimum stages for each of the sub areas within the study area was used as the allowable stage at the end of the irrigation season. The rainfall depth which results from the use of these two stages in the regression relationships may be considered as the amount of rainfall during the irrigation season which under "average" conditions would have resulted in the minimum stage being reached at the end of the irrigation season. Under normal conditions, however, the rainfall which might be expected to fall during this period is the average rainfall between the end of October and the end of May. If a consumptive withdrawal from the groundwater is considered equivalent to preventing an equal amount of rainfall from affecting the water table then the basin yield is the difference between the average rainfall and the rainfall amount calculated using the regression equation.

The parameters used and calculated are presented in the following summary:

	Initial Stage	Final Stage	Regression Rainfall	Average Rainfall	Yield (in inches)
West Glades (North)	4.3	1.05	10.1	18	7.9
West Glades (South)	3.0	-0.4	7.2	18	10.8
East Glades	2.5	0.0	7.7	17	9.3

The somewhat higher yield indicated in the southern portion of the West Glades area may be due, at least in part, to increased seepage gradients toward the area induced by concentrated municipal pumping. As noted in the section dealing with minimum groundwater levels there is some indication that salinity intrusion may be more of an immediate threat in the southern portion of this area and consequently, minimum stages were adjusted upward in this portion of this area in respect to the northern portion. This would have the effect of flattening the gradient and making the yields for the entire West Glades Area more uniform. In addition, some supplemental consumptive use for irrigation is included in the basin yield figures which should be removed making the actual yield somewhat higher. Since there is more irrigation water being used in the northern part of the West Glades Area there is not adequate justification for distinguishing between the northern and southern portion of the West Glades.

Values of 10.0 inches per season for the West Glades Area and 9.0 inches per season for the East Glades Area are suggested for use as the basin yield until more definitive studies are made.

MINIMUM STAGES

Minimum groundwater stages in this area should be set in such a manner as to ensure that the resource is adequately protected against permanent damage from salinity intrusion. Analysis of historic low groundwater conditions indicate that there exists, even at low stages, a definite gradient from the northwestern part of the area towards the east and towards the south. This gradient should be preserved in the establishment of minimum elevation in order that the historic groundwater flow will not be too radically disturbed in times of water stress. This concept also tends to more equally distribute the hardships imposed should it be necessary to apply water use restrictions.

The method chosen for the establishment of the minimum groundwater stages was to assign reference areas to specific groundwater monitoring wells. The applicable indicator well was then given a reference elevation to correspond to the minimum groundwater elevation in its applicable area. These reference elevations were chosen to correspond to elevations approximately 1.0 foot lower than the "average yearly lowest groundwater level during the 1960 - 1972 calendar years" as defined in "Summary of Hydrologic Data Collected During 1972 in Dade County, Florida", Open File Report 73032, USGS, 1973. Smaller deviations from the "average yearly lowest values" were chosen for areas in which some advance of the salt front was noted in recent years. (USGS Open File Report 73005, 1973). The reference elevations conform roughly to the second lowest groundwater level recorded during the historical record.

A summary of the minimum stages is presented in Figure 3. Figure 4 summarizes the USGS data referenced in the above paragraph.

CONSUMPTIVE USE

In previous memorandum reports an implied assumption was made that the moisture holding capacity of the soil was sufficient to accommodate normal variations in the time distribution of rainfall on a monthly basis. This assumption allowed a simplified approach for calculating the supplemental consumptive use requirements. The approach used was to consider all rainfall that occurred during a given month as being effective for the growth of plants if the monthly rainfall did not exceed the consumptive use requirements. All monthly rainfall in excess of the consumptive use requirements was considered as discharged directly to surface or groundwater systems and thus was not directly available for use in subsequent months. This approach is valid in most areas of the District because the required moisture holding capacity in and near the root zone need be only somewhat less than 5 inches (this figure is based on worst condition of a monthly evaporation 7.1 inches, a pan coefficient (evapotranspiration ÷ pan evaporation) of 0.7, and a rainfall of greater than 7 inches occurring entirely on the first or last day of the month - a more normal moisture holding requirement might be in the neighborhood of 3 inches). The USDA has presented the moisture holding capacities of some typical Florida soils in "Moisture Characteristics of Some Representative Soils of Florida", ARS 41-63, 1963. This publication indicates for the soils analyzed, that the required moisture holding capacity is easily met over the majority of the District.

It is realized that this value of supplemental consumptive use is not equivalent to the amount of water which must be applied to the soil for optimum crop growth. The definition of supplemental consumptive use includes only the amount of water required for the evapotranspiration process of the plants and the soil immediately surrounding the individual plants plus some unavoidable evaporation losses which

occur in applying irrigation water. The actual amount of water which must be applied is always considerably greater than this value due to non-uniform soil characteristics, some leaching requirements to prevent the buildup of salts in the root zone, uneven distribution of water by the irrigation systems, and other factors.

In Dade County and in particular the West Glades Area, a unique situation exists. While the moisture holding capacity of the topsoil is very good (0.125 inch water/inch of soil as reported by Dr. K.C. Koo, IFAS) the depth of this soil is very shallow. The natural topsoil varies between 2 inches and 12 inches deep with the majority probably near 6 inches. In order to cultivate the fields, heavy machinery is used to break up the bed rock and mix it with the available soil to a depth from 12 to 20 inches. This results in a very low moisture holding capacity in the soil due to the very shallow soil layer.

The end result of the poor moisture characteristics of the soil is to allow less of the rainfall to be effective for plant utilization in the absence of irrigation. Only a small portion of a large rainfall can be used to replenish soil moisture depleted from the soil near the root zone of the plants. The remainder percolates to the highly permeable groundwater table where it may be available for irrigation or other uses but is not directly available to support crop growth.

No more than 0.75 inch of rainfall over a 3 day period or 1.5 inches over a 7 day period is likely to be available for direct use by crops in this particular area. On this basis, rainfall records for the rainfall station at S-194 were adjusted by considering all 3 day rainfalls larger than 0.75 inch as actually being 0.75 inch to obtain adjusted monthly rainfall values for use in the previously described procedure.

A single station (Homestead Experiment Station) was used for rainfall analysis in this case because regional averages tend to distort intensity values on the order of several days or less.

Special care must be exercised in using these supplemental consumptive use figures because the difference in effective rainfall (and thus supplemental consumptive use) between this procedure and the procedure used in most other areas may for some purposes be irrelevant. This is because the difference in most cases goes to recharging the aquifer and is consequently still available for use.

The results of this analysis are summarized in Table 9. The supplemental consumptive use calculated by the procedure used in previous memorandum reports is given for comparison.

PRESENT IRRIGATION USE & FUTURE PROSPECTS

The Dade County Agricultural Extension Agent estimates that 78 percent of the reported vegetable crop acreage harvested is presently under irrigation and 80 percent of the fruit crop. That agency recommends that irrigation water should be applied such that 1½ inches per week are supplied by either irrigation or rainfall. The amounts applied should not be more than 3/4 inch at any one time. Under the assumption that actual irrigation usage approximated this recommendation, and the 3/4 inch per application was equivalent to 3/4 inch in 3 consecutive days, daily rainfall data at S-194 was used to simulate irrigation withdrawals. Consumptive use of irrigation water was calculated as described in the section on consumptive use for comparison. The results are presented in Table 10. Fruit crops were considered to be irrigated the entire year when necessary. It should be noted that part of the consumptive use for fruit crops occurs during the wet season and thus does not deplete the storage available on which basis the basin yield was calculated. For simplicity truck crops were assumed to be cropped in two groups; 60 percent of the irrigated crop being grown from September 1 through December 31 and 40 percent being grown from January 1 through April 30.

In terms of irrigation efficiency, defined by the ratio of irrigation water consumed in the evapotranspiration process to the total irrigation water applied, Table 10 indicates average efficiencies of 45 percent for fruit crops and 35 percent for truck crops. The consensus of many renowned hydrologists (Linsley & Franzine, Bleney, SCS, Sprinkler Irrigation Association, etc) is that irrigation efficiencies defined in this manner generally range from 10 percent to 80 percent with efficiencies greater than 60 percent requiring special circumstances or the exercise of extreme care in scheduling. On the basis of irrigation efficiencies the values in Table 10 appear reasonable.

An independent estimate of irrigation applied and the portion of the irrigation water which was consumptively used by plants for calendar year 1970 is published in "Estimated Use of Water in Florida, 1970" by R.W. Pride, USGS Open File Report 72021, 1972. This report estimates applied irrigation as 50,200 acre-feet and irrigation water consumed as 30,000 acre-feet. For the comparable time period Table 10 indicates respective values of 86,000 and 36,500 acre-feet. It may be noted that the consumptive use figures agree quite well while the USGS values for applied irrigation are considerably lower. The USGS estimates were obtained by estimating the number and depth of irrigations over the year and assuming an irrigation efficiency of 60 percent to obtain the consumptive use estimate.

Table 8 indicates that under the proposed set of minimum groundwater elevations some sort of restriction would need to be applied nearly every other year on the average. This is somewhat misleading in terms of probable hardships to farmers who need irrigation in order to realize a successful farm operation. A large portion of the truck crops are harvested before any restrictions are likely. If conditions in the past are similar to those in the future, there is almost no chance of any restrictions being applied before the end of January. The probability of some sort of restriction being applied increases progressively as the dry season continues. The probability of restrictions being applied before the end of February increases to 1 in 20 years; March, 1 in 7 years; April, 1 in 2½ years; May, nearly 1 in 2 years. Most truck crops are harvested before the end of April. It is not extremely serious to reduce irrigations for most of the predominate truck crops immediately prior to harvest. The proposed minimum groundwater levels are thus not a severe limitation to the potential for further development of truck crop operations.

There is a somewhat greater possibility of damage to fruit crops which generally require irrigation through April and May. Special consideration may need to be given to those farmers who use drip irrigation systems. Irrigation efficiencies are likely to be much higher for this type of system and thus the same percentage reduction in planned withdrawals is likely to cause a more severe hardship.

In order to translate the values derived from the regression analysis into terms which would provide insight into what degree of agricultural usage this water would support, it is necessary to estimate both the amount of water consumptively used during the period of record from which the regression values were derived and the consumptive use under some future state of development. The method selected utilizes pan evaporation and a multiplication factor developed under local conditions for specific crop types. A coefficient of 0.65 has been found suitable for use on most truck crops to estimate the quantity of water consumptively used by this crop. Since truck crops are presently the predominant product of this region and this trend may be expected to continue for some time, this value was used to predict the future evapotranspiration under full development.

There is a dearth of information on the quantity of water consumed in the evapotranspiration process by natural vegetation under conditions which exist in this area when the area is not cultivated. Since this natural vegetation is not irrigated and the water table at times falls far below what would be considered the root zone of these plants, a reduction in evapotranspiration is expected during dry periods in comparison with wet periods. Experience with pasture grasses in other areas indicates that severe drought conditions reduce the water consumed to less than one-half of the value expected when enough water is supplied to meet optimum growth conditions. Under the assumption that the hetrogeneous mixture of brush, palm, grass, and tree types of vegetation

associated with "natural" vegetation behaves similar to pasture grasses with a good distance to groundwater, coefficients of 0.58, 0.49, and 0.29 were selected as representative of wet, normal and dry categories of dry season precipitation. These values are rather arbitrary and are based on the author's judgement in extending a very limited amount of field data to the conditions prevalent in this area. They should not be used in the general sense without careful consideration of variations in plant, soil, and water conditions. It may be noted that if a pan coefficient of 0.65 is assumed for the wet season months, the total yearly evapotranspiration ranges from 40 inches in wet years to 31 inches in dry years. This compares well with an early estimate of mean yearly evapotranspiration in this area by the USGS. "Water Resources of Southeastern Florida" WSP 1255, USGS, PP. 55 estimates this quantity at 35 inches.

Since there were no apparent time trends in the monthly groundwater data, and figures released by the Dade County Agricultural Agent indicate approximately 50 percent of the area delineated was under production in any one year, the calculated evapotranspiration for natural vegetation and irrigation crops was given equal weight in averaging these values to derive a figure for the probable historical evapotranspiration. The values presented for historical and "natural" evapotranspiration should be considered tentative until further data is obtained to substantiate these values. It may be noted that under the derived cropping scheme the "probable historical evapotranspiration" is nearly constant regardless of moisture condition ranging from wet to dry. While the lack of a time trend in groundwater records, despite an obvious increase in utilization, and the poor correlation between groundwater and pan evaporation can be explained by other means, this is also a possible factor and tends to lead to more confidence in the results.

The additional evapotranspiration required for full development of the agricultural potential can be estimated as the difference between ET under irrigation and the probable historical ET. These values as well as the values mentioned in the preceding paragraphs are summarized in the following table:

Condition	Pan Evap.	Natural		Irrigated		Probable Historical ET Inches	Additional ET Req. For Full Develop.
		Pan Coef.	ET	Pan Coef.	ET		
Wet	33"	.58	19"	.65	21"	20"	1"
Normal	35"	.49	17"	.65	23"	20"	3"
Dry	39"	.29	11"	.65	25"	18"	7"

On the basis of the regression analysis these additional ET requirements for full development would result in stages ranging from 0.2 foot to 1.4 foot lower than observed stages in wet and dry years respectively. In the average year, stages would be expected to be approximately 0.6 foot lower. In the average or in wet years this additional drawdown could be accommodated with very little additional restrictions required. In dry years, however, restrictions would be required earlier and would tend to be more severe. Any large future development should consider the possibility of severe restrictions being applied toward the end of the dry season which might influence flexibility in scheduling of farm operations, cropping patterns, and overall farm economics. The proposed South Dade Conveyance System should tend to provide some relief from necessary restrictions during drier than normal years if and when this system becomes effective.

In the East Glades Area, water tables do not fluctuate to the extent of those in the West Glades Area and it is probable that under natural conditions very little decrease in natural ET would occur during a drought period. Under dry conditions

the probable historical ET was estimated as 21 inches. Thus, a maximum of 4 inches of additional ET requirements might be expected in a dry year. The present analysis does not indicate that this additional draw would be a major problem. This factor might need to be reviewed as more data becomes available or irrigation becomes more prevalent.

WATER SHORTAGE PLAN

The highly permeable shallow water aquifer together with the generally low water tables during drought conditions combine to make a situation which requires defining a water shortage plan to protect the resource from irreversible effects due to salinity intrusion in spite of the relatively generous hydrologic inputs into the area.

The most obvious principle for such a water shortage plan is to limit withdrawals when the groundwater stage reaches a certain critical elevation. This has the obvious advantage of ensuring a sufficient fresh water head to limit the advance of saline water into the interior regions. A single value would not be equitable in the "sharing of the adversity" as there is generally a significant flow of groundwater to the south and east from the northern portion of the area. In addition, normal groundwater elevations decrease from north to south and from west to east.

To overcome this difficulty and to more nearly reflect the effects of local withdrawals, twelve reference wells were selected within the area. Sub-areas were then defined (Figure 3) in which restrictions on withdrawals could be keyed to groundwater elevations in the reference well representative of the particular sub-area. The boundaries of these sub-areas are somewhat arbitrary but were selected to coincide as nearly as possible with the area of influence of a heavily pumped hypothetical well at the same location subject to the constraints of a readily definable boundary and a lack of suitable reference wells in certain areas. The critical elevations were also adjusted somewhat to minimize differences in possible restrictions near the boundaries.

The critical elevations for a 75% reduction in withdrawal were selected to conform roughly with elevations one foot lower than the observed average lowest groundwater level during 1960 - 1972 calendar years (USGS Open File Report 73032, 1973). These elevations were then modified slightly to reflect areas in which salinity had historically been more of a problem and to minimize differences in restrictions across subarea boundaries. This results in the 75% reduction criteria coinciding with the minimum groundwater elevations presented in Figure 2.

It is not expected that all of the water saved by a reduction in withdrawals will remain in storage at a given location because of the natural evapotranspiration process and groundwater flow. An estimate of the quantity that will remain in storage can be obtained from the seasonal regression equations developed earlier by assuming that a given quantity made available through restrictions would have the same effect on stage as an increase in rainfall. Using the seasonal regression relationships and an estimate of 7 inches total supplemental consumptive use, a restriction of 25 percent would result in an increase of groundwater stage of slightly less than 0.4 foot in the West Glades Area.

On this basis, criteria for 50 percent reductions and 25 percent reduction were established at elevations 0.4 foot and 0.8 foot above the critical elevation established for the 75 percent reduction. A similar procedure in the East Glades Area yields 50 percent reductions at 0.2 foot and 25 percent reductions at 0.4 foot above the elevations for a 75 percent reduction. See Table 8 for the reference elevations at which the various levels of restrictions will be applied for each reference well.

In order to eliminate the necessity of checking all reference well elevations during non-critical periods, a relationship was developed with water elevations

at S-194 to predict when a critical period was approaching. Daily water readings at this structure are taken on a routine basis and are available in the Hydrology Division. It was determined that an elevation lower than 1.9 foot msl at the downstream gage on S-194 predicted the approach of an area-wide critical situation with sufficient accuracy to justify initiating the more detailed investigative procedure. A notification of the possibility of implementing the "Water Shortage Plan", as required by statute, could be made at this time.

While the establishment of a "water shortage plan" for public water supplies as well as domestic and essential services was not a specific objective of this dissertation, either a smaller reduction in withdrawals at the given groundwater elevation criteria or a slightly lower elevation could be used to reflect the District policy of a higher priority for these use classifications.

A legitimate argument might be made that the criteria presented for this water shortage plan are very conservative in light of the apparent lack of permanent damage to the aquifer system of localized monthly stages as much as 0.9 foot below the stage at which 75 percent reductions are suggested.

Factors which lend credence to the values selected include the present lack of knowledge as to (1) the effects that severely low stages have on neighboring areas, (2) a lack of knowledge of the inter-relationship between the duration of a given low stage and water quality parameters, (3) no verification of the effectiveness of reductions in withdrawals is presently available, and (4) the mathematical possibility that groundwater levels might fall significantly below the established criteria even with restrictions of 75 percent of more applied. Furthermore, it may be postulated that under certain circumstances it is desirable to instigate restrictions of a severity that can be born without

extreme hardship at an early date in order to reduce the possibility of severe permanent damage which might have disasterous results at a later date.

WATER SUPPLY AND WATER USE ACCOUNTING

Chapters 373.042 and 373.175, Florida Statutes, delineate responsibilities of water management districts in setting minimum levels and declaration of water shortages. "Memorandum Report on Surface Water Availability in the Lake Istokpoga - Indian Prairie Area" as well as similar memorandum reports for St. Lucie County Area and the Caloosahatchee Basin present a discussion of how these Statutes are interpreted in those respective areas.

The Statutes provide that minimum levels be established in order to protect the water resources of the area. In Dade County the obvious and overriding consideration in the protection of the resource is to ensure that undue salinity intrusion does not occur.

The Statutes also provide for adjustment of minimum levels for seasonal variations when appropriate. In this particular area it is felt that seasonal variations are not appropriate because given a definite physical and geological system the danger of salinity intrusion varies primarily with the difference between inland fresh water elevations and sea level. Since the seasonal variations in sea level are insignificant, seasonal variations in this difference need not be considered. Furthermore, inducing a higher fresh water elevation than would naturally occur during the earlier part of the dry season in order to store reserves for the critical period, results in higher seepage losses to brackish waters when it is not required thus resulting in lower storage efficiencies.

Rather than establishing a single set of minimum stages below which no withdrawals could be made, a staged criteria was selected, based on percentage reductions in withdrawals corresponding to successively lower stages. The rationale behind this approach being that many of the farm

operations could tolerate a moderate reduction in withdrawals at a somewhat earlier date better than a sudden and complete termination of withdrawals. This being especially relevant in the case of fruit crops which entail a long term investment in plantings which might be permanently damaged by receiving no water during a critical period. The low moisture holding capacity of the soil was also a major consideration.

The straight percentage reduction in withdrawals keyed to groundwater stages presents a simple and straightforward method of handling the necessary restrictions. Some problems are inherent in its application, however. A major problem being that the same percentage reduction is more severe, in terms of crop response, for a more efficient operation than it is for an operation which applies a considerable amount of excess water. At the present time, a lack of field data on actual volumes of water applied by various systems makes incorporating this factor into the criteria very difficult. Some consideration should be given to making special allowances for irrigation systems such as drip irrigation which have the potential of developing very high efficiencies.

Advance warning of possible restrictions in the form of a "declaration of water shortage" is also required by Statute. A prediction of future groundwater stages is possible with the regression equations developed for this area and long term rainfall forecasts. Logistics problems involved with collection of the required data on a timely basis make the procedure rather cumbersome, however, particularly at times when experience has shown the probability of low stages is remote. Fortunately, surface water stages in some of the project canals correlate fairly well with observed groundwater stages. The downstream gage at S-194 is one of those indicators.

When the water level at this gage reaches an elevation of 1.9 in most cases the stages at the reference wells will soon fall to elevations requiring some sort of restrictions. A declaration of water shortage could be made at this time and an accelerated and detailed program for observation of groundwater stages be initiated.

Reports of actual water withdrawals are required by the District from each permittee in all areas of the District. These reports serve four purposes: (1) the establishment of an actual agricultural water use data base which will serve theoretical water use studies and documentation of a reasonable-beneficial use criteria for the benefit of water users; (2) enable an accounting of use versus allocation to be made on a continuing basis; (3) enable the establishment of more equitable criteria for the enforcement of withdrawal restrictions; (4) provide a basis for checking compliance with any water use restrictions which may be applied during emergency conditions of water shortage.

Due to unique characteristics of the irrigation procedure in a large part of this county, the reporting requirements are unduly cumbersome. In light of this, the District has agreed to temporarily waive individual reporting requirements in exchange for a cooperative program with the Dade County Agricultural Extension Agent in which that office will furnish the results of a demonstration program which will monitor water use on selected farms as part of its objectives. The reporting requirements will be waived for the duration of this program which is expected to last a minimum of three years.

PERMIT CLASSIFICATION

A discussion of the requirements of the Florida Statutes concerning permit classification has been presented in "Memorandum Report on Surface Water Availability in the Lake Istokpoga - Indian Prairie Area".

The same system of permit classification is recommended for the Dade County Area. It is suggested that water uses from the primary canal system and all surface water bodies connected thereto be given the source designation "S" and that water uses from the shallow water table aquifers having substantial hydraulic connection with these surface waters be given the source classification "G-1". Both of these ("S" and "G-1") are to be considered as a single source. Almost all agriculture usage is presently from these two sources.

All other water table aquifer systems, including those which have a partial hydrologic connection with the primary canal system but which normally have chloride concentrations in excess of 1000 ppm, will have the designation "G-2". The Floridan Aquifer will have the designation "G-3". On the assumption there is no hydraulic connection between the "G-2" and "G-3" sources, these will be considered as separate sources.

Use classifications will be as recommended in the Lake Istokpoga- Indian Prairie report. The geographic area will be that generally shown on the map of Figure 1.

In regard to a water shortage plan, this report addresses itself only to source classifications "S" and "G-1" and use classification "livestock and agricultural". It may be expected that, in general, the priority of usage for other use classifications would follow in the same general order as that proposed in the above referenced report. That is (1) Domestic and

essential services; (2) Public water supply; (3) Livestock and agricultural; (4) Industrial and mining; (5) Recreational. Specific recommendations on the nature of the formula for restrictions in other use classifications are not presently available and will be forthcoming in a separate report.

A substantial portion of the irrigated crop in this area is not in a permanent location. This creates several major problems in the permitting process:

1. A lack of continuity from year to year with respect to geographical location of acreage irrigated (principally a problem with vegetables and papaya; not a problem with other fruits).

2. The acreage in production is not fixed at the beginning of the growing season; acreage may be added during the growing season dependent on market conditions and other factors.

3. A large portion of the acreage in production is leased, thus presenting some problems as to properly identifying the applicant, the permittee and the user.

4. Possible problems with "repeat" acreage; i.e., the same acreage may be planted in two different crops during the same growing season or two crops planted concurrently as may be done when establishing a new fruit tree grove; e.g., the open areas between trees may be used for one or more truck crop plantings.

Normal procedure in the District is to issue water use permits to the user rather than to the landowner if the acreage is farmed by a lessee. In this particular area it may be more appropriate to issue the necessary permit to the landowner, mainly because of problems in identifying the lessee.

The landowner would apply for an initial water use permit for all of his holdings which he feels might potentially be irrigated on a lease basis. The type of information required in the intitial water use permit application is listed in "How to Apply for a Permit" FCD, January 1974. In addition to the information normally required, the landowner must include: (1) an estimate of the amount of land anticipated to be leased the next growing season as well as the location; (2) the name and address of the lessee, or the lessees, involved and the land descriptions for the individual leased areas; (3) the method of irrigation used on each parcel. It is realized that the landowner may not be aware of the exact quantity of water nor the details of future lessee's irrigation schedule. In this case the landowner may specify "normal use" and the District staff can substitute area averages for these quantities.

No later than the August 1st following the initial growing season applied for (and every year thereafter) the landowner must file a letter stating the actual quantities estimated for items (1), (2) & (3) above which occurred during the last growing season and an estimate of these items for the next year. If any significant changes in his intended leasing arrangements occur during the year, it is his responsibility to inform the District of these changes. No new permit nor permit application will be required each year. In the case of owner operated farms the procedure would be the same as in other areas of the District.

Normally a report of monthly or annual pumpage is required of all permittees. In this case the landowner would be responsible for securing this information from the lessee(s) and forwarding the information to the District along with

the other required yearly information. This water withdrawal reporting requirement, however, has been waived in this area for the duration of a cooperative demonstration program between IFAS and FCD as described in another section of this report.

WEIGHTED RAINFALL ON WEST DADE AG AREA - INCHES

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1960	.42	1.91	.75	9.54	6.56	9.26	11.02	7.57	23.85	7.84	2.31	.65	81.68
1961	5.60	.85	2.25	.06	10.01	10.87	2.49	5.62	2.80	4.30	.83	.31	45.99
1962	1.76	.64	3.37	2.68	1.55	10.98	6.68	7.75	8.68	2.09	2.56	.32	49.06
1963	.46	3.17	.63	.51	7.22	9.56	2.51	6.09	15.04	4.51	1.66	3.50	54.86
1964	.55	2.28	1.00	5.18	2.85	11.58	5.41	8.64	6.06	9.59	1.98	3.16	58.28
1965	1.42	3.48	1.53	1.75	.18	6.61	5.37	4.29	11.65	12.88	4.27	.28	53.71
1966	4.67	2.35	3.31	2.14	8.14	18.77	6.12	3.61	8.56	8.00	.67	.95	67.29
1967	2.29	1.11	2.82	.38	3.29	15.62	6.58	4.93	7.14	10.61	2.64	1.35	58.76
1968	1.90	1.81	1.19	.87	20.00	19.01	8.61	8.66	13.30	10.70	.94	.03	87.02
1969	3.95	2.19	1.83	6.36	5.36	19.82	7.76	9.11	9.06	13.27	1.56	.44	80.71
1970	2.59	2.35	2.02	.46	8.59	8.18	5.35	2.86	6.42	5.42	.22	.10	44.56
1971	.48	1.43	.33	.08	3.97	6.70	5.08	4.91	8.40	5.90	3.12	2.67	43.07
1972	.95	2.67	2.83	4.51	10.26	8.85	7.99	6.96	6.32	2.93	3.67	2.59	60.53
1973	3.52	2.52	1.94	1.05	1.95	6.43	9.41	12.27	6.66	4.47	.76	2.45	53.43
AVE.	2.18	2.05	1.84	2.54	6.42	11.59	6.46	6.66	9.57	7.32	1.94	1.34	59.92
STD DEV	1.75	.86	1.03	2.96	5.25	4.95	2.49	2.64	5.37	3.77	1.26	1.30	14.78
SKEW	.796	-0.162	.117	1.443	1.496	.811	.044	.565	1.797	.305	.453	.613	.855
KURTOSIS	3.68	3.63	2.93	5.67	7.52	3.25	4.12	4.42	8.35	2.90	3.42	2.64	3.685
MAXIMUM	5.60	3.48	3.37	9.54	20.00	19.82	11.02	12.27	23.85	13.27	4.27	3.50	87.02
MINIMUM	.42	.64	.33	.06	.18	6.43	2.49	2.86	2.80	2.09	.22	.03	43.07
MEDIAN	1.83	2.23	1.89	1.40	5.96	10.22	6.35	6.53	8.48	6.87	1.82	.80	56.57

TABLE 1

WEIGHTED RAINFALL ON EAST DADE AG AREA - INCHES

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1960	.43	1.91	.61	8.46	6.90	9.87	10.25	8.39	21.86	7.23	2.27	.53	78.71
1961	3.96	1.03	2.06	.05	10.57	9.03	2.99	5.75	2.73	4.27	.75	.41	43.60
1962	1.79	.84	3.49	1.95	1.57	12.11	7.64	6.99	8.36	2.61	2.73	.17	50.25
1963	.40	3.39	.35	.42	7.21	9.73	2.57	6.39	15.08	4.25	2.17	2.86	54.82
1964	.52	2.19	.84	5.24	3.06	10.24	5.57	8.02	7.90	9.28	1.93	2.64	57.43
1965	1.44	3.41	1.45	.58	.76	7.04	4.40	4.23	12.01	11.49	5.20	.26	52.27
1966	4.36	1.63	2.62	2.03	7.70	18.08	8.08	3.19	8.99	7.30	.58	1.00	65.56
1967	2.43	1.29	2.48	.30	2.30	16.98	5.58	4.78	7.92	10.11	2.33	1.34	57.84
1968	1.76	1.75	1.30	.46	16.67	17.43	7.42	7.93	13.97	9.39	1.05	.13	79.26
1969	4.01	2.04	3.21	3.99	5.84	18.89	4.73	7.29	11.10	12.02	1.44	.82	75.38
1970	2.41	2.28	1.70	.41	6.88	9.41	5.79	3.85	5.93	6.22	.74	.13	45.75
1971	.44	1.47	.34	.06	3.48	9.20	5.46	5.82	8.01	5.81	3.01	2.57	45.67
1972	1.35	2.75	2.99	5.59	7.66	9.22	7.59	4.41	5.76	4.00	3.14	1.66	56.12
1973	2.25	2.54	1.27	.66	2.56	8.08	8.65	11.34	6.11	3.53	.64	2.95	50.58
AVE.	1.97	2.04	1.76	2.16	5.94	11.81	6.19	6.31	9.69	6.96	2.00	1.25	58.09
STD DEV	1.42	.82	1.10	2.74	4.37	4.29	2.26	2.29	5.03	3.20	1.34	1.13	12.58
SKEW	.575	.402	.209	1.415	1.244	.880	.049	.705	1.255	.283	1.112	.585	.829
KURTOSIS	3.31	3.63	2.81	5.23	6.39	3.05	3.65	4.72	6.28	2.82	5.86	2.64	3.514
MAXIMUM	4.36	3.41	3.49	8.46	16.67	18.89	10.25	11.34	21.86	12.02	5.20	2.95	79.26
MINIMUM	.40	.84	.34	.05	.76	7.04	2.57	3.19	2.73	2.61	.58	.13	43.60
MEDIAN	1.77	1.97	1.58	.62	6.36	9.80	5.69	6.10	8.19	6.72	2.05	.91	55.47

TABLE 2

AREA AVERAGED PAN EVAPORATION OVER THE DADE COUNTY AG AREAS - INCHES

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1960	4.09	3.90	5.64	6.99	7.10	5.95	6.81	7.20	4.96	4.99	4.25	3.58	65.46
1961	3.02	3.84	5.99	6.72	6.86	6.54	6.81	6.48	6.34	5.28	3.94	3.62	65.44
1962	3.15	3.97	5.34	6.32	7.09	5.38	6.77	5.91	5.11	5.60	3.52	2.78	60.94
1963	3.20	3.52	6.13	6.95	6.54	6.34	7.21	6.91	4.86	5.44	4.08	2.77	63.95
1964	3.12	3.79	5.28	6.70	7.06	6.74	7.31	6.64	6.31	5.24	3.88	3.62	65.69
1965	3.85	3.77	5.81	6.80	8.09	6.91	7.66	6.69	5.86	5.51	4.44	3.82	69.21
1966	3.46	4.35	5.50	7.02	6.78	7.37	6.58	7.34	5.59	5.52	4.30	3.15	66.96
1967	3.52	4.01	5.46	6.37	6.66	6.00	7.30	6.51	6.39	5.46	3.74	3.69	65.11
1968	3.43	3.88	5.48	6.25	6.45	6.48	7.46	6.57	5.44	5.21	3.74	3.34	63.73
1969	3.86	4.18	4.96	6.06	7.60	6.46	7.20	7.02	6.02	5.47	3.75	3.58	66.16
1970	3.40	3.67	5.62	6.96	7.26	6.77	6.81	7.16	7.05	6.03	4.04	4.27	69.04
1971	3.58	4.81	6.07	7.17	9.06	6.68	7.06	7.12	5.54	5.69	4.55	3.76	71.09
1972	3.63	4.27	6.59	7.45	7.25	6.93	8.48	7.04	5.86	6.79	5.29	4.03	73.61
1973	3.96	3.91	6.61	7.45	7.51	7.72	6.07	6.63	5.79	5.85	4.37	4.27	70.14
AVE.	3.52	3.99	5.75	6.80	7.24	6.59	7.11	6.80	5.79	5.58	4.14	3.59	66.90
STD DEV	.34	.34	.50	.45	.71	.61	.59	.40	.63	.45	.47	.48	3.49
SKEW	.191	1.249	.512	-0.169	1.609	-0.124	.730	-0.777	.295	1.744	1.237	-0.433	.370
KURTOSIS	3.12	6.35	3.86	3.35	7.42	4.97	6.41	4.94	4.10	8.51	6.51	3.99	4.118
MAXIMUM	4.09	4.81	6.61	7.45	9.06	7.72	8.48	7.34	7.05	6.79	5.29	4.27	73.61
MINIMUM	3.02	3.52	4.96	6.06	6.45	5.38	6.07	5.91	4.86	4.99	3.52	2.77	60.94
MEDIAN	3.49	3.91	5.63	6.88	7.10	6.61	7.13	6.80	5.83	5.49	4.06	3.62	65.92

TABLE 3

ADJUSTED MONTH-END GROUND WATER ELEVATIONS - FEET MSL FOR G 799

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1960	3.32	3.30	3.10	3.85	4.20	3.65	3.85	4.25	6.70	5.20	4.10	4.02	49.54
1961	4.50	3.75	3.28	3.05	3.55	3.90	3.48	3.38	3.60	3.53	3.18	2.75	41.95
1962	2.53	2.12	1.93	1.60	1.48	3.45	3.95	4.15	4.20	3.65	3.55	3.50	36.11
1963	3.40	3.43	2.87	2.45	2.65	3.35	2.80	3.20	4.25	3.65	3.36	3.59	39.00
1964	3.45	3.35	2.90	2.40	2.85	3.25	2.60	3.00	3.65	3.70	3.15	3.72	38.02
1965	3.45	3.60	3.30	2.60	2.15	2.50	2.95	3.25	3.70	4.35	3.55	3.40	38.80
1966	3.50	3.35	3.30	2.95	4.00	4.40	3.30	3.65	4.40	4.25	3.30	3.10	43.50
1967	3.00	2.87	2.93	2.15	2.00	3.35	3.00	3.10	3.90	3.70	3.40	3.20	36.60
1968	3.08	3.15	2.85	2.20	4.60	4.25	3.75	3.95	4.35	4.30	3.47	3.31	43.26
1969	3.50	3.45	3.40	3.55	4.10	4.45	4.05	3.70	3.75	3.75	3.75	3.65	45.10
1970	3.34	3.19	2.97	2.55	2.91	3.54	3.32	3.17	3.17	3.53	3.14	2.63	37.46
1971	2.45	2.10	1.52	1.00	1.30	2.55	3.08	3.57	3.35	3.75	3.20	3.05	30.92
1972	3.00	2.95	2.80	2.70	3.75	3.55	3.85	3.85	3.48	3.12	3.10	3.00	39.15
1973	2.61	2.53	2.78	1.84	1.34	2.44	3.25	4.08	3.60	3.10	3.11	3.06	33.74
AVE.	3.22	3.08	2.85	2.49	2.92	3.47	3.37	3.59	4.01	3.83	3.38	3.28	39.51
STD DEV	.54	.53	.55	.77	1.18	.68	.48	.43	.89	.57	.30	.40	5.00
SKEW	.729	-0.982	-1.730	-0.092	-0.119	-0.182	-0.034	.155	2.676	1.206	1.369	.133	.342
KURTOSIS	6.18	4.16	7.04	4.57	2.62	3.45	2.86	2.65	12.82	6.35	6.06	3.71	4.501
MAXIMUM	4.50	3.75	3.40	3.85	4.60	4.45	4.05	4.25	6.70	5.20	4.10	4.02	49.54
MINIMUM	2.45	2.10	1.52	1.00	1.30	2.44	2.60	3.00	3.17	3.10	3.10	2.63	30.92
MEDIAN	3.33	3.24	2.92	2.50	2.88	3.49	3.31	3.61	3.73	3.70	3.33	3.26	38.90

TABLE 4a

ADJUSTED MONTH-END GROUND WATER ELEVATIONS - FEET MSL FOR G 596

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1960	7.55	7.15	6.45	6.25	6.35	6.75	6.90	7.50	8.35	8.58	8.30	7.90	88.03
1961	7.65	6.90	6.00	4.95	5.70	6.80	6.20	6.05	5.90	5.25	4.50	3.60	69.50
1962	3.25	2.65	2.55	2.30	2.60	4.55	6.30	6.70	7.00	5.85	5.35	4.85	53.95
1963	4.55	4.60	3.60	2.55	2.95	5.10	4.30	5.75	6.70	5.75	5.00	5.80	56.65
1964	4.75	4.10	3.40	3.20	3.05	5.05	5.55	5.95	6.15	6.15	5.60	5.60	58.55
1965	5.10	5.35	4.60	3.55	2.55	3.15	3.70	4.50	5.90	6.65	5.55	4.70	55.30
1966	5.05	4.75	4.60	4.15	5.75	7.10	7.30	7.00	7.15	7.00	6.00	4.95	70.80
1967	4.70	4.40	3.85	2.83	2.30	5.55	5.50	5.30	5.35	6.00	5.50	4.90	56.18
1968	4.35	3.85	3.25	3.25	6.30	7.25	6.50	6.40	7.20	7.00	5.90	4.95	66.20
1969	5.50	4.95	4.30	4.75	5.95	6.65	6.65	6.75	6.75	7.00	6.60	5.65	71.50
1970	6.00	5.75	5.10	4.00	5.10	6.90	6.30	6.00	6.10	5.95	4.70	3.90	65.80
1971	3.30	2.85	2.25	1.40	2.10	3.65	4.50	5.00	5.45	5.40	4.78	4.42	45.10
1972	4.05	4.00	3.60	3.83	5.50	6.45	6.00	6.30	6.25	5.39	5.40	4.76	61.53
1973	4.70	4.24	1.17	2.41	1.71	3.16	5.49	6.25	6.44	5.61	3.50	4.57	49.25
AVE.	5.04	4.68	3.91	3.53	4.14	5.58	5.80	6.10	6.48	6.26	5.48	5.04	62.02
STD DEV	1.37	1.35	1.48	1.30	1.86	1.54	1.08	.83	.82	.94	1.15	1.06	11.39
SKEW	.914	.500	-0.004	.511	-0.018	-0.604	-0.743	-0.380	.823	1.374	1.001	1.671	.810
KURTOSIS	4.78	4.28	4.22	4.61	1.97	2.90	3.99	4.35	5.31	6.34	7.26	8.81	5.405
MAXIMUM	7.65	7.15	6.45	6.25	6.35	7.25	7.30	7.50	8.35	8.58	8.30	7.90	88.03
MINIMUM	3.25	2.65	1.17	1.40	1.71	3.15	3.70	4.50	5.35	5.25	3.50	3.60	45.10
MEDIAN	4.72	4.50	3.72	3.40	4.07	6.00	6.10	6.15	6.34	5.97	5.45	4.88	60.04

TABLE 4b

ADJUSTED MONTH-END GROUND WATER ELEVATIONS - FEET MSL FOR G 858

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1960	5.52	5.43	4.70	5.26	5.85	6.18	6.44	7.44	8.81	8.11	6.76	6.09	76.59
1961	6.34	5.30	4.54	3.84	4.61	5.82	5.00	4.51	4.62	4.20	3.69	3.12	55.59
1962	2.75	2.31	2.12	1.94	1.84	5.14	5.60	6.00	6.35	4.76	4.35	3.86	47.02
1963	3.55	3.58	3.00	2.51	2.81	4.10	3.54	4.19	5.40	4.62	4.16	4.13	45.59
1964	3.75	3.53	3.00	2.57	2.84	4.40	4.34	4.60	4.90	4.79	4.50	4.43	47.65
1965	4.19	4.41	3.86	3.19	2.35	2.66	2.97	3.59	4.54	5.62	4.41	3.80	45.59
1966	3.98	3.72	3.77	3.11	4.42	5.57	4.76	4.77	4.76	5.07	4.35	3.82	52.10
1967	3.65	3.57	3.29	2.54	2.00	4.84	4.36	3.83	4.51	4.74	4.10	3.45	44.88
1968	3.18	2.92	2.72	2.47	5.44	5.74	4.71	5.18	5.84	5.13	4.43	3.96	51.72
1969	4.36	4.16	3.52	3.82	4.94	5.18	4.99	5.06	5.03	5.39	4.60	4.04	55.09
1970	4.47	4.31	4.00	3.24	4.17	4.75	4.42	4.17	4.45	4.29	3.70	3.12	49.09
1971	2.57	2.22	1.58	1.05	1.38	2.68	3.32	4.37	4.48	4.39	4.00	3.68	35.72
1972	3.33	3.29	3.03	3.13	4.48	4.68	4.89	4.96	4.80	4.13	4.13	3.69	48.54
1973	3.74	3.33	2.88	2.08	1.41	2.51	4.09	5.16	5.67	4.10	3.47	3.42	41.86
AVE.	3.96	3.72	3.29	2.91	3.47	4.59	4.53	4.84	5.30	4.95	4.33	3.90	49.79
STD DEV	1.05	.99	.90	1.05	1.60	1.26	.94	1.01	1.21	1.06	.80	.76	9.65
SKEW	1.108	.296	-0.202	.586	.024	-0.762	.228	1.564	2.462	2.588	2.628	2.277	1.859
KURTOSIS	5.64	4.01	4.15	5.84	2.49	3.55	4.75	7.65	11.13	12.26	13.12	11.19	9.973
MAXIMUM	6.34	5.43	4.70	5.26	5.85	6.18	6.44	7.44	8.81	8.11	6.76	6.09	76.59
MINIMUM	2.57	2.22	1.58	1.05	1.38	2.51	2.97	3.59	4.45	4.10	3.47	3.12	35.72
MEDIAN	3.74	3.57	3.16	2.84	3.51	4.79	4.56	4.68	4.85	4.75	4.26	3.81	48.09

TABLE 4c

ADJUSTED MONTH-END GROUND WATER ELEVATIONS - FEET MSL FOR G 757A

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1960	5.45	5.15	4.50	5.00	5.50	6.60	6.35	7.65	8.70	8.15	6.80	5.85	75.70
1961	6.10	5.25	4.25	3.40	4.50	6.40	5.45	4.90	4.55	4.20	3.50	2.65	55.15
1962	2.30	1.85	1.75	1.65	1.45	5.00	6.00	6.15	6.55	5.00	4.35	3.65	45.70
1963	3.22	3.20	2.60	1.87	2.45	4.65	3.90	4.75	7.05	5.20	4.20	3.80	46.89
1964	3.75	3.35	2.70	2.10	2.60	4.80	4.75	5.25	5.60	5.75	5.05	4.45	50.15
1965	3.75	3.97	3.60	2.60	1.65	2.00	2.55	3.50	5.15	6.50	4.85	3.70	43.82
1966	4.00	3.65	3.40	3.15	4.75	7.00	6.05	5.40	5.45	5.30	4.45	3.75	56.35
1967	3.55	3.45	3.05	2.00	1.20	5.40	3.80	4.03	4.10	4.70	3.90	3.20	42.38
1968	2.77	2.30	2.20	1.25	5.75	6.55	5.00	4.85	5.85	5.00	4.05	3.30	48.87
1969	3.85	3.50	3.07	3.30	4.90	5.75	5.30	5.25	5.20	5.35	4.50	3.70	53.67
1970	3.90	3.60	3.15	2.45	3.20	4.95	4.50	3.80	4.15	4.50	3.30	2.50	44.00
1971	1.95	1.70	1.10	.30	.95	2.45	3.05	3.70	4.25	4.25	3.60	3.02	30.32
1972	2.70	2.75	2.55	2.63	4.08	4.73	5.07	4.59	4.83	4.80	3.89	3.16	45.78
1973	3.19	2.75	2.38	1.44	1.00	1.85	4.31	5.55	5.53	4.10	2.96	3.28	38.34
AVE.	3.61	3.32	2.88	2.37	3.14	4.87	4.72	4.95	5.50	5.20	4.24	3.57	48.37
STD DEV	1.16	1.09	.95	1.19	1.82	1.75	1.16	1.13	1.31	1.11	.97	.86	10.79
SKEW	.911	.393	-0.021	.568	.130	-0.793	-0.452	1.016	1.358	1.860	1.551	1.684	1.166
KURTOSIS	5.25	4.22	4.36	5.54	2.40	3.72	3.71	6.02	6.36	8.39	8.07	8.49	7.739
MAXIMUM	6.10	5.25	4.50	5.00	5.75	7.00	6.35	7.65	8.70	8.15	6.80	5.85	75.70
MINIMUM	1.95	1.70	1.10	.30	.95	1.85	2.55	3.50	4.10	4.10	2.96	2.50	30.32
MEDIAN	3.65	3.40	2.88	2.28	2.90	4.97	4.88	4.88	5.32	5.00	4.13	3.48	46.33

TABLE 4d

ADJUSTED MONTH-END GROUND WATER ELEVATIONS - FEET MSL FOR G 1362

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1969	4.31	3.87	3.07	3.55	5.11	5.72	5.25	5.26	5.13	5.27	4.66	3.86	55.06
1970	4.27	4.20	3.81	2.95	3.77	5.08	4.73	4.19	4.32	4.66	3.66	2.88	48.52
1971	2.31	2.04	1.46	.70	.85	2.40	3.29	4.21	4.33	4.42	3.85	3.39	33.25
1972	3.03	3.11	2.79	2.87	4.71	4.98	4.88	4.85	4.89	4.20	4.21	3.53	48.05
1973	3.59	3.13	2.65	1.73	1.12	2.22	4.48	5.77	5.21	4.28	3.34	3.23	40.75
1974	3.09	2.28	1.46	.90	1.17	2.72	4.13	4.42	-0	-0	-0	-0	20.17
AVE.	3.43	3.10	2.54	2.12	2.79	3.85	4.46	4.78	3.98	3.81	3.29	2.81	40.97
STD DEV	.85	.93	1.02	1.29	2.15	1.72	.75	.70	2.18	2.09	1.83	1.55	13.84
SKEW	-0.181	-0.005	-0.126	-0.151	.192	.076	-1.071	.800	-2.464	-2.426	-2.237	-2.374	-0.957
KURTOSIS	6.36	5.88	6.31	5.03	4.24	4.16	9.03	6.62	14.17	14.15	13.34	13.81	8.000
MAXIMUM	4.31	4.20	3.81	3.55	5.11	5.72	5.25	5.77	5.21	5.27	4.66	3.86	55.06
MINIMUM	2.31	2.04	1.46	.70	.85	2.22	3.29	4.19	-0	-0	-0	-0	20.17
MEDIAN	3.34	3.12	2.72	2.30	2.47	3.85	4.60	4.64	4.61	4.35	3.76	3.31	44.40

TABLE 4e

ADJUSTED MONTH-END GROUND WATER ELEVATIONS - FEET MSL FOR G 1363

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1969	3.39	3.01	2.53	2.73	4.01	5.10	5.04	5.02	5.10	4.87	3.94	3.28	48.02
1970	3.33	3.10	2.60	1.71	2.73	4.58	3.91	3.18	3.82	4.16	2.77	1.99	37.88
1971	1.48	1.20	.43	-0.31	0	2.24	2.77	3.59	3.79	3.88	3.09	2.48	24.64
1972	2.22	2.50	2.29	2.37	4.43	4.58	4.49	4.38	4.37	3.57	3.35	2.70	41.25
1973	2.63	2.40	1.91	1.01	.60	2.30	4.31	5.37	5.03	3.82	2.65	2.73	34.76
1974	2.18	1.37	.57	.07	.58	2.50	4.10	4.23	-0	-0	-0	-0	15.60
AVE.	2.54	2.26	1.72	1.26	2.06	3.55	4.10	4.29	3.69	3.38	2.63	2.20	33.69
STD DEV	.81	.88	1.07	1.35	2.10	1.46	.83	.91	2.07	1.88	1.50	1.26	12.87
SKEW	-0.123	-0.560	-0.804	-0.179	.280	.076	-1.117	-0.065	-2.158	-2.259	-1.990	-1.932	-0.651
KURTOSIS	6.47	5.52	5.36	5.44	4.68	3.98	10.27	6.24	12.95	13.57	12.59	12.09	7.232
MAXIMUM	3.39	3.10	2.60	2.73	4.43	5.10	5.04	5.37	5.10	4.87	3.94	3.28	48.02
MINIMUM	1.48	1.20	.43	-0.31	0	2.24	2.77	3.18	-0	-0	-0	-0	15.60
MEDIAN	2.42	2.45	2.10	1.36	1.67	3.54	4.20	4.30	4.09	3.85	2.93	2.59	36.32

TABLE 4f

ADJUSTED MONTH-END GROUND WATER ELEVATIONS - FEET MSL FOR G 614

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1960	3.67	3.50	2.88	3.79	4.77	5.77	5.16	6.90	7.98	6.71	5.10	4.05	60.28
1961	4.58	3.59	2.80	2.11	3.29	4.91	3.94	3.89	3.45	3.24	2.44	1.76	40.00
1962	1.52	1.09	1.17	1.03	.62	4.31	4.89	4.75	5.42	4.19	3.37	2.63	34.99
1963	2.20	2.31	1.63	1.07	1.88	4.03	3.14	4.06	7.10	5.50	3.33	2.90	39.15
1964	2.77	2.41	1.90	1.65	2.59	3.91	3.87	4.26	4.81	4.83	3.85	3.23	40.08
1965	2.69	2.74	2.45	1.53	.78	1.34	1.94	2.87	4.32	6.17	3.84	2.78	33.45
1966	2.94	2.57	2.34	2.06	4.10	6.38	5.22	4.25	4.46	4.08	3.26	2.58	44.24
1967	2.45	2.28	2.01	1.08	.59	4.23	4.49	3.25	3.01	3.48	2.88	2.24	31.99
1968	1.96	1.70	1.35	1.12	5.56	6.13	4.00	3.74	5.53	4.72	3.03	2.50	41.34
1969	2.98	2.63	2.25	2.50	3.55	5.12	4.18	4.32	4.16	4.16	3.22	2.42	41.49
1970	2.82	2.68	2.32	1.56	2.52	4.26	3.56	2.75	3.12	3.58	2.40	1.72	33.29
1971	1.32	1.18	.50	-0.24	0	1.98	2.48	3.11	3.52	3.50	2.84	2.28	22.47
1972	2.00	2.18	2.00	2.00	3.89	4.03	4.00	3.60	3.87	3.11	2.98	2.38	36.04
1973	2.31	2.11	1.77	.95	.71	1.70	3.68	4.92	4.50	3.30	2.33	2.32	30.60
AVE.	2.59	2.35	1.96	1.59	2.49	4.15	3.90	4.05	4.66	4.33	3.21	2.56	37.81
STD DEV	.88	.75	.67	.96	1.84	1.62	.97	1.09	1.50	1.17	.75	.61	8.90
SKEW	.861	-0.110	-0.752	.573	.164	-0.552	-0.600	1.507	1.231	1.018	1.385	1.163	1.083
KURTOSIS	5.60	4.33	4.83	6.47	2.84	3.74	4.47	7.82	5.28	4.19	7.13	6.82	7.769
MAXIMUM	4.58	3.59	2.88	3.79	5.56	6.38	5.22	6.90	7.98	6.71	5.10	4.05	60.28
MINIMUM	1.32	1.09	.50	-0.24	0	1.34	1.94	2.75	3.01	3.11	2.33	1.72	22.47
MEDIAN	2.57	2.36	2.01	1.54	2.55	4.24	3.97	3.97	4.39	4.12	3.13	2.46	37.59

TABLE 4g

ADJUSTED MONTH-END GROUND WATER ELEVATIONS - FEET MSL FOR 789

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1960	4.70	4.25	3.30	4.55	5.25	6.00	5.95	6.55	7.00	6.85	6.15	5.20	65.75
1961	5.45	4.40	3.40	2.60	4.55	5.65	4.55	4.80	4.75	3.90	2.90	1.95	48.90
1962	1.85	1.20	1.45	1.20	1.25	4.00	5.65	5.90	6.05	5.20	3.85	2.80	40.40
1963	2.25	2.45	1.55	1.00	2.75	4.75	3.80	4.70	6.25	5.25	3.85	4.25	42.85
1964	3.15	2.65	1.70	2.70	2.95	4.65	4.55	4.85	5.35	5.25	5.15	4.10	47.05
1965	3.00	3.10	2.50	1.05	.35	1.85	2.75	3.65	5.40	6.15	4.60	3.05	37.45
1966	3.55	2.90	2.60	2.25	4.25	6.50	6.05	5.35	5.80	5.15	4.00	2.80	51.20
1967	3.25	2.70	2.15	.90	.40	5.85	4.46	4.30	4.80	5.20	4.12	2.82	40.95
1968	2.68	2.44	1.83	1.84	5.12	6.34	5.32	4.77	5.63	5.20	3.84	3.12	48.13
1969	3.89	3.47	3.03	2.71	3.67	5.01	5.79	5.46	5.36	4.96	4.40	3.70	51.45
1970	4.00	3.75	3.05	2.00	3.35	5.05	4.35	3.60	4.45	4.40	3.00	2.20	43.20
1971	1.80	1.60	.80	-0.05	3.40	3.20	3.15	3.95	4.00	4.45	3.40	2.85	32.55
1972	2.60	2.90	2.60	2.75	4.95	4.95	4.98	4.95	4.75	3.94	2.99	3.27	45.63
1973	3.09	2.82	2.40	1.30	.91	2.60	4.53	5.44	5.56	4.22	2.99	3.53	39.39
AVE.	3.23	2.90	2.31	1.91	3.08	4.74	4.71	4.88	5.37	5.01	3.95	3.26	45.35
STD DEV	1.07	.92	.80	1.18	1.80	1.45	1.05	.87	.81	.84	.96	.88	8.28
SKEW	.661	-0.099	-0.368	.607	-0.461	-0.836	-0.485	.211	.284	.744	1.052	.782	1.092
KURTOSIS	4.44	4.32	3.51	5.31	2.90	4.10	3.74	4.04	4.39	5.02	5.38	5.07	6.835
MAXIMUM	5.45	4.40	3.40	4.55	5.25	6.50	6.05	6.55	7.00	6.85	6.15	5.20	65.75
MINIMUM	1.80	1.20	.80	-0.05	.35	1.85	2.75	3.60	4.00	3.90	2.90	1.95	32.55
MEDIAN	3.12	2.86	2.45	1.92	3.38	4.98	4.55	4.82	5.38	5.17	3.85	3.09	44.42

TABLE 4h

ADJUSTED MONTH-END GROUND WATER ELEVATIONS - FEET MSL FOR F 358

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1960	2.78	2.60	2.08	2.98	3.13	4.26	3.69	3.99	4.92	4.88	3.37	2.80	41.48
1961	3.23	2.70	2.16	1.55	2.67	3.97	2.85	3.14	3.12	1.85	1.85	1.30	30.39
1962	1.05	.45	.80	.55	.15	1.85	3.25	3.80	4.40	3.15	2.40	1.75	23.60
1963	1.40	1.50	.70	.20	1.85	3.15	2.35	3.65	5.30	3.50	2.45	2.40	28.45
1964	2.05	1.60	.80	1.45	2.50	3.15	3.05	3.55	3.70	3.85	2.85	2.15	30.70
1965	1.75	1.70	1.20	.15	-0.40	.60	1.55	2.50	3.50	4.55	2.75	1.80	21.65
1966	2.20	1.75	1.60	1.25	3.10	4.85	3.90	3.45	3.60	3.00	2.30	1.70	32.70
1967	1.70	1.50	1.20	.25	.30	3.65	2.80	2.65	2.80	3.55	2.50	1.70	24.60
1968	1.57	1.37	.90	1.05	4.25	4.70	3.35	3.10	4.00	3.55	2.35	1.85	32.04
1969	2.35	2.10	1.92	1.80	2.65	3.50	3.65	3.75	3.60	3.30	2.65	2.05	33.32
1970	2.30	2.10	1.70	1.80	2.20	3.45	2.80	2.30	3.00	2.85	1.80	1.30	27.60
1971	.95	.75	0	-0.80	-0.40	2.30	2.15	2.40	2.55	2.95	2.10	1.90	16.85
1972	1.60	1.80	1.80	1.65	3.55	3.45	3.05	3.40	3.07	2.61	2.30	1.89	30.17
1973	1.74	1.79	1.42	.47	.37	1.87	3.00	3.67	4.00	2.65	1.78	2.20	24.96
AVE.	1.90	1.69	1.31	1.02	1.85	3.20	2.96	3.24	3.68	3.30	2.39	1.91	28.47
STD DEV	.66	.63	.64	.99	1.61	1.23	.66	.59	.82	.81	.45	.41	6.23
SKEW	.543	-0.377	-0.491	.089	-0.265	-0.741	-0.708	-0.568	.693	.431	.546	.533	.157
KURTOSIS	4.33	4.79	3.91	4.52	2.69	4.48	4.79	2.90	4.13	4.81	4.81	5.09	5.214
MAXIMUM	3.23	2.70	2.16	2.98	4.25	4.85	3.90	3.99	5.30	4.88	3.37	2.80	41.48
MINIMUM	.95	.45	0	-0.80	-0.40	.60	1.55	2.30	2.55	1.85	1.78	1.30	16.85
MEDIAN	1.74	1.73	1.31	1.15	2.35	3.45	3.03	3.42	3.60	3.23	2.38	1.87	29.31

TABLE 4i

ADJUSTED MONTH-END GROUND WATER ELEVATIONS - FEET MSL FOR G 864

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1960	2.49	2.25	1.57	2.34	3.38	3.83	4.06	4.99	5.12	4.42	3.38	2.83	40.66
1961	3.28	2.32	1.64	1.07	2.95	3.50	2.65	3.12	2.78	2.44	1.64	1.17	28.56
1962	1.01	.46	.85	.55	.26	4.50	3.66	3.85	4.83	3.04	2.86	1.75	27.62
1963	1.38	1.57	.53	.33	1.66	2.92	2.17	3.26	5.07	3.41	2.39	2.26	26.95
1964	1.83	1.49	.64	1.46	2.67	3.10	2.81	3.39	3.61	3.52	2.84	2.30	29.66
1965	1.68	1.66	.97	-0.09	-0.63	.44	1.71	2.55	3.34	4.45	2.62	1.89	20.59
1966	2.29	1.69	1.58	1.20	3.45	4.73	3.99	3.24	3.36	3.00	2.32	1.62	32.47
1967	1.75	1.46	1.02	.10	.41	4.47	2.74	2.62	3.37	3.07	2.28	1.85	25.14
1968	1.59	1.46	1.00	.29	4.01	4.78	3.17	2.91	4.21	3.74	2.31	2.11	31.58
1969	2.43	2.38	2.03	1.90	3.26	4.28	3.53	3.72	3.98	3.85	3.32	2.20	36.88
1970	2.50	2.20	1.72	.78	1.81	3.53	2.69	2.31	2.92	2.76	1.88	1.35	26.45
1971	1.07	.81	.03	-0.80	-0.28	2.03	2.12	2.76	2.72	2.90	2.37	2.03	17.76
1972	1.79	1.92	1.89	1.83	3.67	3.68	3.17	3.40	3.03	2.90	2.42	2.07	31.77
1973	1.98	1.78	1.32	.50	.34	2.14	2.56	3.93	3.72	2.87	2.30	2.28	25.72
AVE.	1.93	1.67	1.20	.82	1.93	3.42	2.93	3.29	3.72	3.31	2.49	1.98	28.70
STD DEV	.64	.57	.60	.90	1.69	1.28	.73	.72	.85	.64	.50	.44	6.17
SKEW	.510	-0.832	-0.442	.068	-0.320	-1.190	.099	1.007	.665	.792	.379	-0.158	.192
KURTOSIS	4.49	4.80	3.68	3.73	2.44	5.53	3.40	5.87	3.30	3.85	4.39	4.77	4.697
MAXIMUM	3.28	2.38	2.03	2.34	4.01	4.78	4.06	4.99	5.12	4.45	3.38	2.83	40.66
MINIMUM	1.01	.46	.03	-0.80	-0.63	.44	1.71	2.31	2.72	2.44	1.64	1.17	17.76
MEDIAN	1.81	1.67	1.17	.66	2.24	3.61	2.77	3.25	3.49	3.05	2.38	2.05	28.09

TABLE 4j

ADJUSTED MONTH-END GROUND WATER ELEVATIONS - FEET MSL FOR G 613

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1960	2.20	1.90	1.15	2.10	3.00	3.25	3.50	4.25	4.45	4.00	3.05	2.35	35.20
1961	2.85	2.00	1.25	.40	3.00	2.70	2.30	2.70	2.40	2.10	1.35	.80	23.85
1962	.75	.15	.60	.10	0	3.10	3.10	3.40	3.45	2.65	2.10	1.45	20.85
1963	1.10	1.35	.15	-0.55	1.50	2.40	1.70	2.80	4.20	2.95	2.15	2.10	21.85
1964	1.55	1.25	.25	1.00	2.50	2.65	2.50	2.85	3.10	2.95	2.50	2.25	25.35
1965	1.45	1.35	.50	-0.55	-0.95	.50	1.60	1.75	3.10	3.60	2.25	1.40	16.00
1966	1.85	1.40	1.25	1.00	2.75	4.00	3.35	2.85	3.35	2.80	2.05	1.45	28.10
1967	1.65	1.25	.70	-0.20	.65	3.50	2.05	1.95	2.65	2.45	1.90	1.65	20.20
1968	1.30	1.15	.70	.50	2.85	2.95	2.30	2.30	2.70	2.45	1.85	1.55	22.60
1969	1.90	1.85	1.70	1.60	2.00	2.65	2.50	2.55	2.65	2.75	2.50	2.20	26.85
1970	1.96	1.69	1.18	1.27	1.73	2.78	2.31	1.84	2.46	2.45	1.56	1.10	22.33
1971	.85	.55	-0.20	-1.05	-0.25	1.90	1.80	2.10	2.10	2.35	2.00	1.95	14.10
1972	1.55	1.70	1.60	1.60	2.65	2.55	2.42	2.55	2.40	2.35	2.17	1.87	25.41
1973	1.72	1.55	1.05	.20	.25	1.98	2.65	2.61	2.74	2.33	1.75	2.18	21.01
AVE.	1.62	1.37	.85	.53	1.55	2.64	2.43	2.61	2.98	2.73	2.08	1.74	23.12
STD DEV	.57	.53	.58	.97	1.41	.86	.60	.68	.71	.54	.44	.49	5.37
SKEW	.480	-1.236	-0.286	-0.004	-0.580	-1.131	.482	1.133	1.096	1.475	.552	-0.501	.549
KURTOSIS	5.14	5.77	3.47	3.16	2.89	7.18	3.80	6.30	4.71	6.09	5.37	3.52	5.813
MAXIMUM	2.85	2.00	1.70	2.10	3.00	4.00	3.50	4.25	4.45	4.00	3.05	2.35	35.20
MINIMUM	.75	.15	-0.20	-1.05	-0.95	.50	1.60	1.75	2.10	2.10	1.35	.80	14.10
MEDIAN	1.60	1.37	.88	.45	1.86	2.67	2.36	2.58	2.72	2.55	2.08	1.76	22.46

TABLE 4k

ADJUSTED MONTH-END GROUND WATER ELEVATIONS - FEET MSL FOR G 1183

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1960	1.55	1.47	1.08	.75	1.80	2.80	2.49	2.55	4.34	3.50	1.75	1.72	25.80
1961	1.89	1.85	1.13	.45	-0.50	3.00	1.85	2.00	1.94	1.67	1.80	1.10	18.18
1962	.90	.35	1.50	.40	.50	2.55	1.75	1.80	3.00	1.60	1.60	1.25	17.20
1963	1.35	1.30	.65	.60	1.25	1.55	1.55	2.20	2.80	2.40	1.50	1.75	18.90
1964	1.30	1.10	.70	.55	1.55	1.90	2.05	2.10	2.10	2.05	1.80	1.20	18.40
1965	1.20	1.20	.80	.40	.10	.90	1.45	2.00	2.75	2.35	1.60	1.40	16.15
1966	1.55	1.55	1.35	1.10	2.35	2.50	2.25	2.05	1.95	1.75	1.60	1.20	21.20
1967	1.10	1.25	.95	.30	.50	1.75	1.95	2.05	2.50	2.20	1.55	1.30	17.40
1968	1.40	1.30	.90	1.00	2.50	2.50	2.25	2.20	2.55	2.10	1.60	1.70	22.00
1969	1.50	1.65	1.65	1.65	2.05	2.30	2.10	2.50	2.40	2.40	1.75	1.40	23.35
1970	1.50	1.50	1.30	.70	1.95	2.35	2.05	1.95	2.20	1.95	1.40	1.40	20.25
1971	1.25	1.00	.30	-0.45	-0.05	2.00	2.10	2.30	2.15	2.40	1.75	1.75	16.50
1972	1.55	1.60	1.70	1.50	2.55	2.20	2.21	2.49	2.01	2.42	1.67	1.41	23.31
1973	1.50	1.65	1.46	.60	.80	2.00	2.30	2.80	2.52	1.97	1.69	1.47	20.76
AVE.	1.40	1.34	1.10	.68	1.24	2.16	2.02	2.21	2.52	2.20	1.65	1.43	19.96
STD DEV	.25	.39	.43	.54	1.05	.56	.30	.29	.65	.49	.12	.23	3.03
SKEW	-0.161	-1.467	-0.295	-0.006	-0.272	-0.806	-0.646	.703	2.160	1.589	-0.513	.325	.534
KURTOSIS	5.21	7.50	3.48	5.39	2.75	5.32	4.12	3.94	10.18	8.52	3.88	2.92	3.503
MAXIMUM	1.89	1.85	1.70	1.65	2.55	3.00	2.49	2.80	4.34	3.50	1.80	1.75	25.80
MINIMUM	.90	.35	.30	-0.45	-0.50	.90	1.45	1.80	1.94	1.60	1.40	1.10	16.15
MEDIAN	1.45	1.38	1.10	.60	1.40	2.25	2.08	2.15	2.45	2.15	1.64	1.40	19.57

TABLE 41

ADJUSTED MONTH-END GROUND WATER ELEVATIONS - FEET MSL FOR G 860

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1960	2.70	2.40	1.90	1.70	3.00	3.95	3.95	4.25	8.80	6.00	4.50	3.20	46.35
1961	3.50	3.00	2.30	1.80	2.50	3.70	2.20	2.10	1.80	1.80	1.60	1.40	27.70
1962	1.20	1.15	1.20	1.10	1.10	2.30	2.40	2.45	3.00	3.00	3.30	2.50	24.70
1963	1.85	1.85	1.40	1.45	1.90	2.40	1.60	1.90	3.25	2.85	2.25	2.35	25.05
1964	1.85	1.65	1.30	1.35	2.25	2.40	1.85	1.95	2.30	2.70	2.70	2.65	24.95
1965	2.35	2.55	2.05	1.80	1.45	1.75	2.00	2.20	2.65	3.15	2.50	2.35	26.80
1966	2.45	2.45	2.40	1.85	2.50	2.65	2.10	2.05	2.10	2.25	2.35	2.15	27.30
1967	2.15	1.85	2.10	1.75	1.70	3.15	2.70	2.45	2.70	3.00	2.55	2.00	28.10
1968	1.95	1.80	1.55	1.40	3.25	3.30	3.00	3.15	3.25	3.25	2.60	2.00	30.50
1969	2.50	2.30	2.75	3.05	3.25	3.20	3.00	3.15	3.05	3.25	2.90	2.25	34.65
1970	2.65	2.50	2.25	1.70	3.15	3.35	2.60	2.40	3.10	2.95	2.35	2.10	31.10
1971	1.80	1.50	1.10	.60	1.00	2.30	2.50	3.15	3.10	3.30	2.80	2.75	25.90
1972	2.40	2.50	2.30	2.25	3.40	3.15	3.20	3.15	3.37	2.75	2.79	2.55	33.81
1973	2.67	2.79	2.31	1.58	1.10	2.04	2.62	3.43	2.93	2.37	2.68	2.61	29.13
AVE.	2.29	2.16	1.92	1.67	2.25	2.83	2.55	2.70	3.24	3.04	2.70	2.35	29.72
STD DEV	.57	.55	.54	.58	.91	.68	.63	.72	1.73	.99	.67	.44	5.94
SKEW	.204	-0.355	-0.321	.737	-0.153	.061	.684	.820	3.344	2.486	1.555	-0.257	2.160
KURTOSIS	5.44	3.39	2.87	7.18	2.46	3.06	5.01	4.29	16.54	12.79	9.31	5.66	9.797
MAXIMUM	3.50	3.00	2.75	3.05	3.40	3.95	3.95	4.25	8.80	6.00	4.50	3.20	46.35
MINIMUM	1.20	1.15	1.10	.60	1.00	1.75	1.60	1.90	1.80	1.80	1.60	1.40	24.70
MEDIAN	2.38	2.35	2.08	1.70	2.38	2.90	2.55	2.45	3.03	2.97	2.64	2.35	27.90

TABLE 4m

ADJUSTED MONTH-END GROUNDWATER ELEVATIONS, WEST DADE AG AREA - FEET MSL

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1960	4.58	4.33	3.76	4.46	4.91	5.31	5.29	6.03	7.34	6.67	5.65	5.06	63.39
1961	5.35	4.52	3.72	3.07	4.18	5.23	4.47	4.34	4.27	3.84	3.21	2.50	48.70
1962	2.25	1.75	1.73	1.49	1.41	4.04	5.06	5.30	5.52	4.52	3.91	3.37	40.35
1963	3.04	3.11	2.38	1.77	2.56	4.14	3.41	4.22	5.77	4.60	3.78	3.89	42.67
1964	3.46	3.11	2.44	2.35	2.79	4.14	3.94	4.35	4.80	4.84	4.32	4.07	44.61
1965	3.45	3.60	3.14	2.14	1.43	2.12	2.75	3.43	4.66	5.55	4.25	3.39	39.91
1966	3.68	3.33	3.15	2.83	4.35	5.86	5.09	4.80	5.19	4.90	3.95	3.28	50.41
1967	3.27	3.03	2.73	1.73	1.34	4.70	3.73	3.77	4.18	4.47	3.80	3.16	39.91
1968	2.89	2.66	2.31	1.83	5.12	5.61	4.63	4.52	5.25	4.84	3.84	3.29	46.79
1969	3.76	3.49	3.18	3.27	4.28	5.05	4.94	4.77	4.75	4.73	4.29	3.74	50.25
1970	3.80	3.57	3.12	2.47	3.22	4.56	4.11	3.63	3.97	4.16	3.19	2.51	42.31
1971	2.12	1.83	1.18	.45	1.56	2.72	3.13	3.71	3.87	4.11	3.42	3.04	31.14
1972	2.81	2.88	2.67	2.71	4.21	4.42	4.55	4.46	4.35	3.95	3.47	3.18	43.66
1973	3.01	2.75	2.29	1.54	1.10	2.33	4.01	4.92	4.83	3.82	2.96	3.30	36.86
AVE.	3.39	3.14	2.70	2.29	3.03	4.30	4.22	4.45	4.91	4.64	3.86	3.41	44.35
STD DEV	.88	.81	.75	1.00	1.53	1.22	.81	.73	.93	.79	.69	.67	7.90
SKEW	.812	-0.113	-0.500	.427	-0.020	-0.778	-0.444	.653	1.588	1.596	1.413	1.142	.939
KURTOSIS	5.36	4.38	4.37	5.41	2.28	3.76	3.38	4.77	7.67	7.59	7.63	6.82	6.680
MAXIMUM	5.35	4.52	3.76	4.46	5.12	5.86	5.29	6.03	7.34	6.67	5.65	5.06	63.39
MINIMUM	2.12	1.75	1.18	.45	1.10	2.12	2.75	3.43	3.87	3.82	2.96	2.50	31.14
MEDIAN	3.36	3.11	2.70	2.24	3.01	4.49	4.29	4.40	4.78	4.56	3.82	3.30	43.16

TABLE 5

ADJUSTED MONTH-END GROUNDWATER ELEVATIONS, EAST DADE AG AREA - FEET MSL

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
1960	2.07	1.88	1.35	1.55	2.50	3.29	3.17	3.49	5.20	4.22	2.78	2.27	33.77
1961	2.59	2.18	1.48	.79	1.38	3.14	2.15	2.35	2.18	1.84	1.64	1.09	22.81
1962	.92	.44	1.11	.45	.42	2.59	2.42	2.60	3.29	2.32	2.12	1.58	20.26
1963	1.37	1.43	.64	.37	1.50	2.12	1.69	2.48	3.56	2.76	1.92	2.03	21.87
1964	1.55	1.29	.68	.92	2.05	2.34	2.26	2.45	2.60	2.62	2.27	1.86	22.89
1965	1.53	1.53	.97	.33	-0.03	.90	1.60	2.02	2.92	3.09	2.07	1.61	18.54
1966	1.86	1.68	1.53	1.22	2.57	3.22	2.73	2.44	2.57	2.28	1.94	1.49	25.53
1967	1.51	1.38	1.10	.40	.73	2.71	2.20	2.15	2.61	2.56	1.93	1.57	20.85
1968	1.48	1.35	.95	.93	2.92	3.01	2.51	2.49	2.87	2.56	1.93	1.72	24.72
1969	1.88	1.87	1.88	1.89	2.31	2.69	2.54	2.76	2.72	2.75	2.26	1.85	27.40
1970	1.92	1.79	1.47	1.16	2.12	2.77	2.30	2.03	2.52	2.37	1.65	1.42	23.52
1971	1.19	.93	.26	-0.48	.03	2.05	2.09	2.40	2.34	2.60	2.04	2.00	17.45
1972	1.70	1.80	1.78	1.67	2.83	2.60	2.53	2.72	2.47	2.48	2.08	1.79	26.45
1973	1.79	1.83	1.48	.64	.64	1.99	2.53	2.95	2.82	2.22	1.89	1.95	22.73
AVE.	1.67	1.53	1.19	.85	1.57	2.53	2.34	2.52	2.90	2.62	2.04	1.73	23.49
STD DEV	.42	.46	.48	.65	1.09	.65	.42	.40	.78	.57	.29	.31	4.25
SKEW	.432	-1.144	-0.469	-0.223	-0.301	-1.319	-0.043	1.143	2.541	2.049	1.256	-0.343	1.068
KURTOSIS	5.51	5.90	3.81	4.36	2.57	6.70	5.08	6.45	11.74	10.46	7.40	4.68	6.422
MAXIMUM	2.59	2.18	1.88	1.89	2.92	3.29	3.17	3.49	5.20	4.22	2.78	2.27	33.77
MINIMUM	.92	.44	.26	-0.48	-0.03	.90	1.60	2.02	2.18	1.84	1.64	1.09	17.45
MEDIAN	1.63	1.60	1.23	.86	1.77	2.64	2.36	2.46	2.66	2.56	1.99	1.75	22.85

TABLE 6

TABLE 7 - SOUTH DADE COUNTY GROUNDWATER REGRESSION COEFFICIENTS

SOUTHERN WEST GLADES AREA

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	IRRIGATION SEASON
A	-0.285	-0.457	-0.768	-0.637	-0.135	+1.331	+0.802	+0.772	+1.059	+0.550	+0.521	+0.010	-2.576
B	0.188	0.233	0.300	0.173	0.172	0.100	0.114	0.098	0.077	0.104	0.042	0.155	0.188
C_2	0.878	0.855	0.843	0.885	1.017	0.336	0.402	0.584	0.547	0.520	0.553	0.714	0.274
r^2	0.940	0.924	0.886	0.869	0.907	0.700	0.752	0.648	0.742	0.719	0.712	0.788	0.798
Se (ft)	0.158	0.165	0.210	0.353	0.497	0.607	0.335	0.395	0.407	0.355	0.252	0.210	0.842

NORTHERN WEST GLADES AREA

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	IRRIGATION SEASON
A	-0.232	-0.313	-0.395	-0.646	-0.450	+1.471	+1.231	+0.751	+0.950	+0.465	+0.401	-0.206	-2.081
B	0.193	0.230	0.177	0.162	0.206	0.115	0.137	0.127	0.123	0.123	0.040	0.153	0.194
C_2	0.897	0.868	0.877	0.937	0.960	0.491	0.455	0.657	0.618	0.645	0.690	0.851	0.271
r^2	0.961	0.971	0.973	0.951	0.938	0.793	0.776	0.719	0.905	0.817	0.879	0.920	0.857
Se (ft)	0.180	0.138	0.122	0.226	0.420	0.635	0.414	0.468	0.354	0.408	0.251	0.184	0.711

WEST GLADES AREA (COMBINED)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	IRRIGATION SEASON
A	-0.2145	-0.3587	-0.4246	-0.5925	-0.9741	+0.5817	+1.3193	+0.9216	+1.2562	0.7075	-0.0598	-0.3536	-2.070
B	+0.1789	+0.2290	+0.1702	+0.1569	+0.1688	+0.0928	+0.1386	+0.1004	+0.1033	+0.1017	+0.0315	+0.1993	+0.175
C_2	+0.9060	+0.8932	+0.8934	+0.9362	+0.9016	+0.5295	+0.4706	+0.6796	+0.5985	+0.6490	+0.8316	+0.9061	+0.383
r^2	.964	.978	.968	.962	.927	.801	.736	.777	.927	.831	.900	.904	.815
Se (ft)	0.173	0.123	0.136	0.202	0.426	0.572	0.433	0.361	0.264	0.388	0.228	0.216	0.61

EAST GLADES AREA

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	IRRIGATION SEASON
A	-0.170	-0.542	+0.158	-0.155	-0.174	+1.690	+0.905	+0.868	-0.111	+0.079	+1.117	+0.069	-0.447
B	0.169	0.176	0.413	0.128	0.118	0.046	0.137	0.065	0.104	0.074	0.017	0.178	+0.169
C_2	0.850	1.002	0.246	0.573	1.188	0.241	0.214	0.535	0.805	0.700	0.388	0.712	-0.334
r^2	0.945	0.953	0.891	0.852	0.872	0.528	0.912	0.743	0.843	0.869	0.709	0.778	0.837
Se (ft)	0.103	0.105	0.164	0.264	0.403	0.470	0.129	0.211	0.324	0.216	0.164	0.153	0.546

End of month stage - A + B x (month's rainfall) + C x (previous month-end stage)

End of season stage (May) = $A_S + B_S$ x (seasonal rainfall) + C_S x (end of October stage)

TABLE 8

WATER LEVELS IN REFERENCE WELLS
AT WHICH RESTRICTIONS WILL BE APPLIED

WELL #	ELEVATION FOR GIVEN RESTRICTION, FEET MSL			% OF YEARS WATER LEVELS WERE BELOW RESTRICTION ELEVATION		
	25%	50%	75%	25%	50%	75%
799	2.4	2.0	1.6	46	21	21
858	2.3	1.9	1.5	29	21	14
757A	2.0	1.6	1.2	50	36	21
1362	1.9	1.5	1.1	50*	42*	28*
1363	1.4	1.0	0.6	50*	42*	42*
614	1.3	0.9	0.5	50	36	7
789	1.2	0.8	0.4	46	21	7
358	0.4	0.0	-0.4	46	14	14
864	0.4	0.0	-0.4	50	14	14
613	0.4	0.0	-0.4	50	36	21
1183	0.4	0.2	0.0	36	21	14
860	0.6	0.4	0.2	7	0	0
Average	1.21	0.83	.45	42.5	25	18

* very short record

TABLE 9

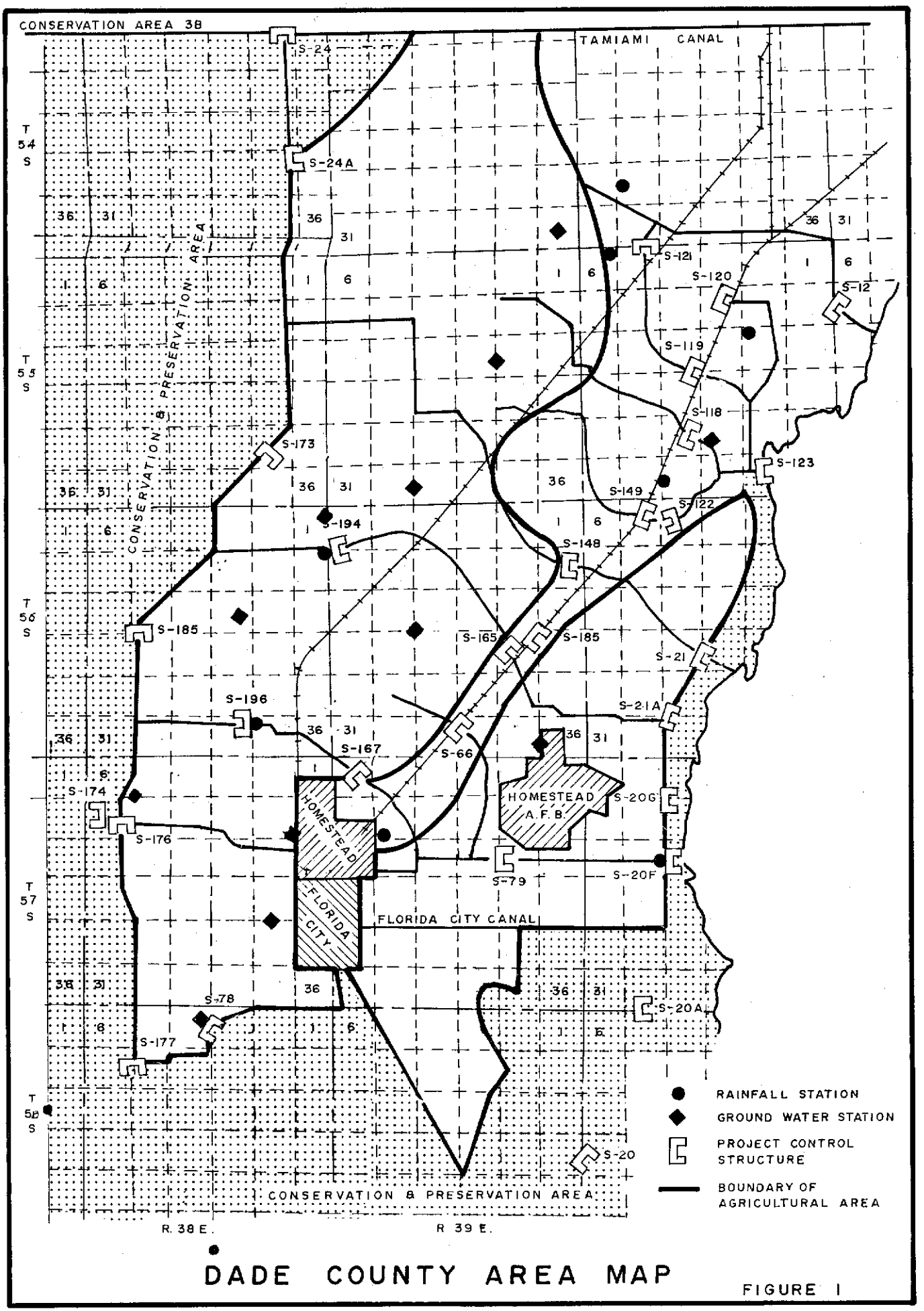
CONSUMPTIVE USE OF CROPS

Water Year	Total Consumptive Use (Inch)	Rain (Inch)	Supplemental Consumptive Use (Inch)	Supplemental Consumptive Use Without Correction For Shallow Depth (Inch)	Total Consumptive Use	Rain (Inch)	Supplemental Consumptive Use	Supplemental Consumptive Use Without Correction For Shallow Depth (Inch)
	FRUIT (NOV. - OCT.)				TRUCK (NOV. - MAY)			
1966-67	46.11	56.57	20.17	14.58	21.76	11.51	15.02	12.51
1967-78	45.21	74.64	12.62	10.40	21.40	29.76	10.44	9.66
1968-69	45.43	80.94	19.47	10.32	21.93	20.66	12.72	8.00
1969-70	46.49	77.03	23.82	13.67	22.26	18.01	14.10	9.63
1970-71	50.97	34.84	28.16	20.95	25.35	6.61	21.55	18.28
1971-72	48.71	58.00	23.44	8.64	24.38	27.01	11.99	4.87
1971-73	51.70	50.29	18.32	11.94	25.19	17.24	14.78	10.62
1973-74	48.80	49.43	23.55	22.10	26.70	8.26	19.79	18.44
Mean	47.93	60.22	21.19	14.08	23.62	17.38	15.05	11.50

TABLE 10

IRRIGATION & SUPPLEMENTAL CONSUMPTIVE USE

Water Year	FRUIT				TRUCK				TOTAL	
	Total Acres Harvested	Estimated Irrigation Applied (Inches)	Irrigation Applied Acre-Feet	Consumptive Use of Irrigation Acre-Feet	Total Acres Harvested	Estimated Irrigation Applied (Inches)	Irrigation Applied Acre-Feet	Consumptive Use of Irrigation Acre-Feet	Estimated Irrigation Applied Acre-Feet	Irrigation Consumed Acre-Feet
1966-67	11,100	47.87	35,400	14,900	43,900	15.62	44,600	15,200	80,000	30,100
1967-68	11,400	34.77	26,400	9,600	43,300	16.14	45,400	9,500	71,800	19,100
1968-69	11,700	40.92	31,900	15,200	43,700	14.63	41,600	13,400	73,500	28,600
1969-70	11,900	42.66	33,700	18,900	43,300	17.00	52,300	17,600	86,000	36,500
1970-71	11,400	55.13	41,900	21,400	44,500	20.34	58,800	25,700	100,700	47,100
1971-72	11,600	43.72	34,100	18,100	43,100	16.34	45,800	13,800	79,900	31,900
1972-73	11,700	48.36	37,700	14,300	45,100	17.01	49,900	20,400	87,600	34,700
1973-74	11,800	47.38	37,300	11,800	41,000	18.32	48,800	20,500	86,100	32,300
Mean	11,575	45.10	34,800	15,525	43,990	16.93	48,400	17,000	83,200	32,540



DADE COUNTY AREA MAP

FIGURE 1

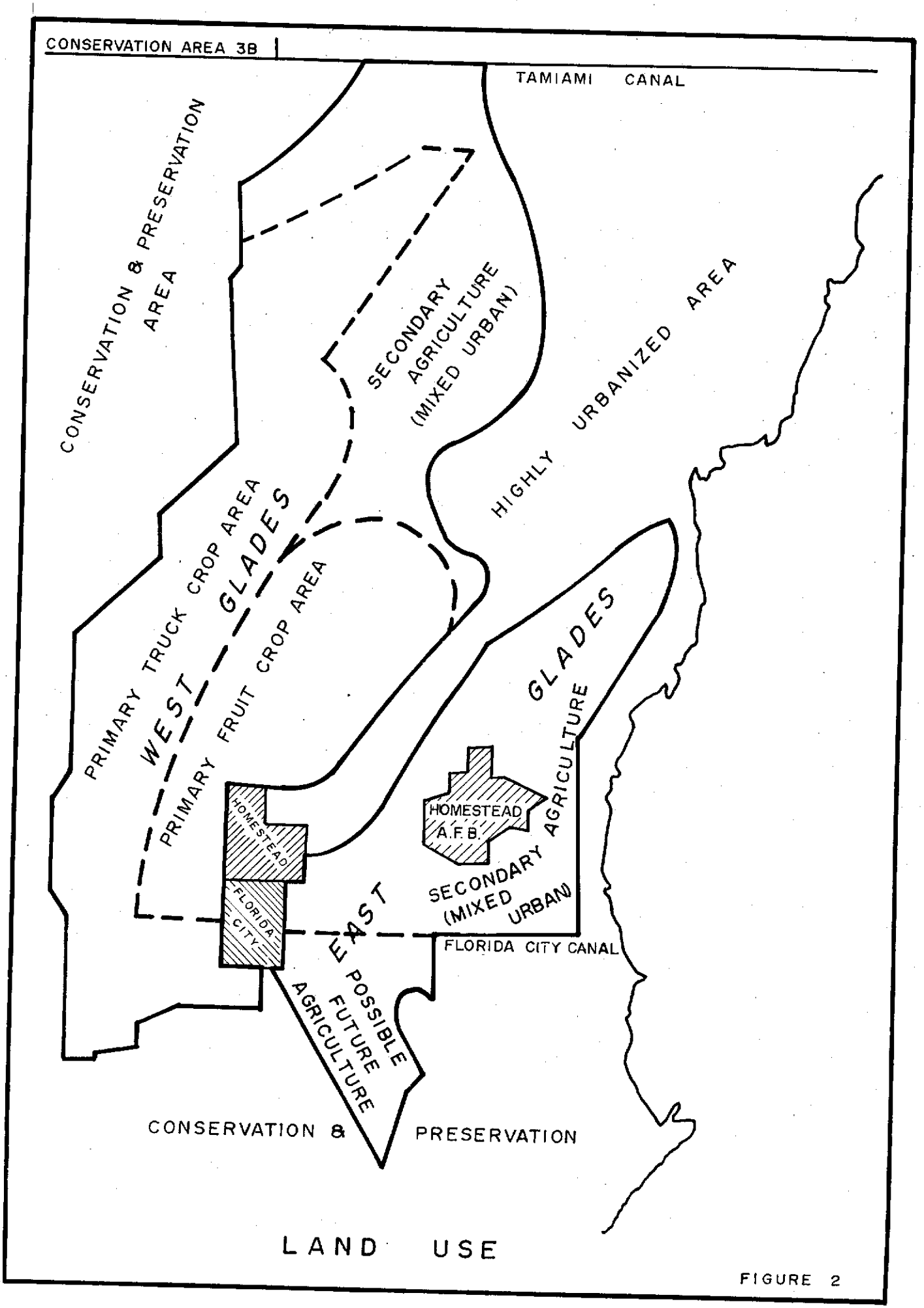
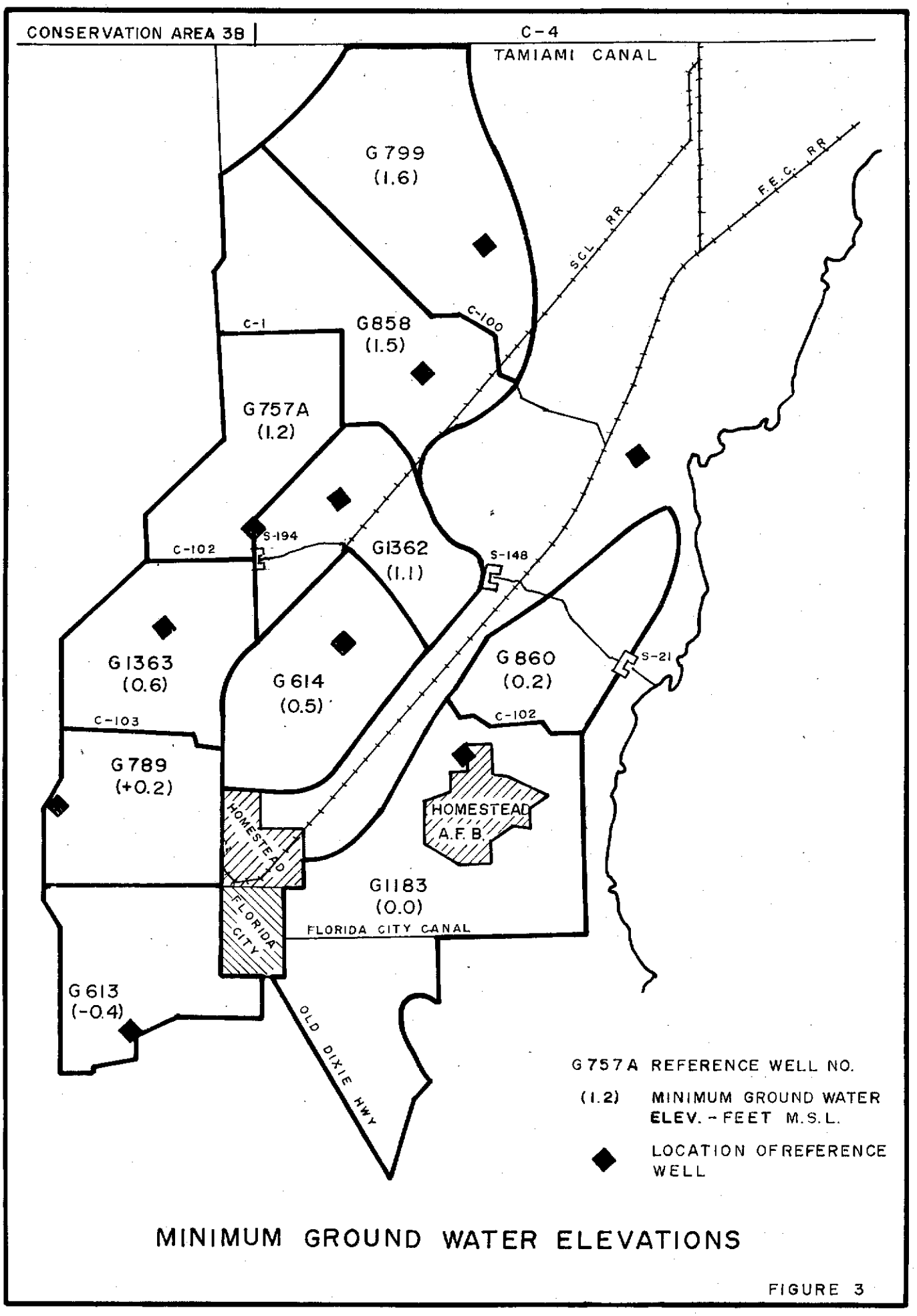
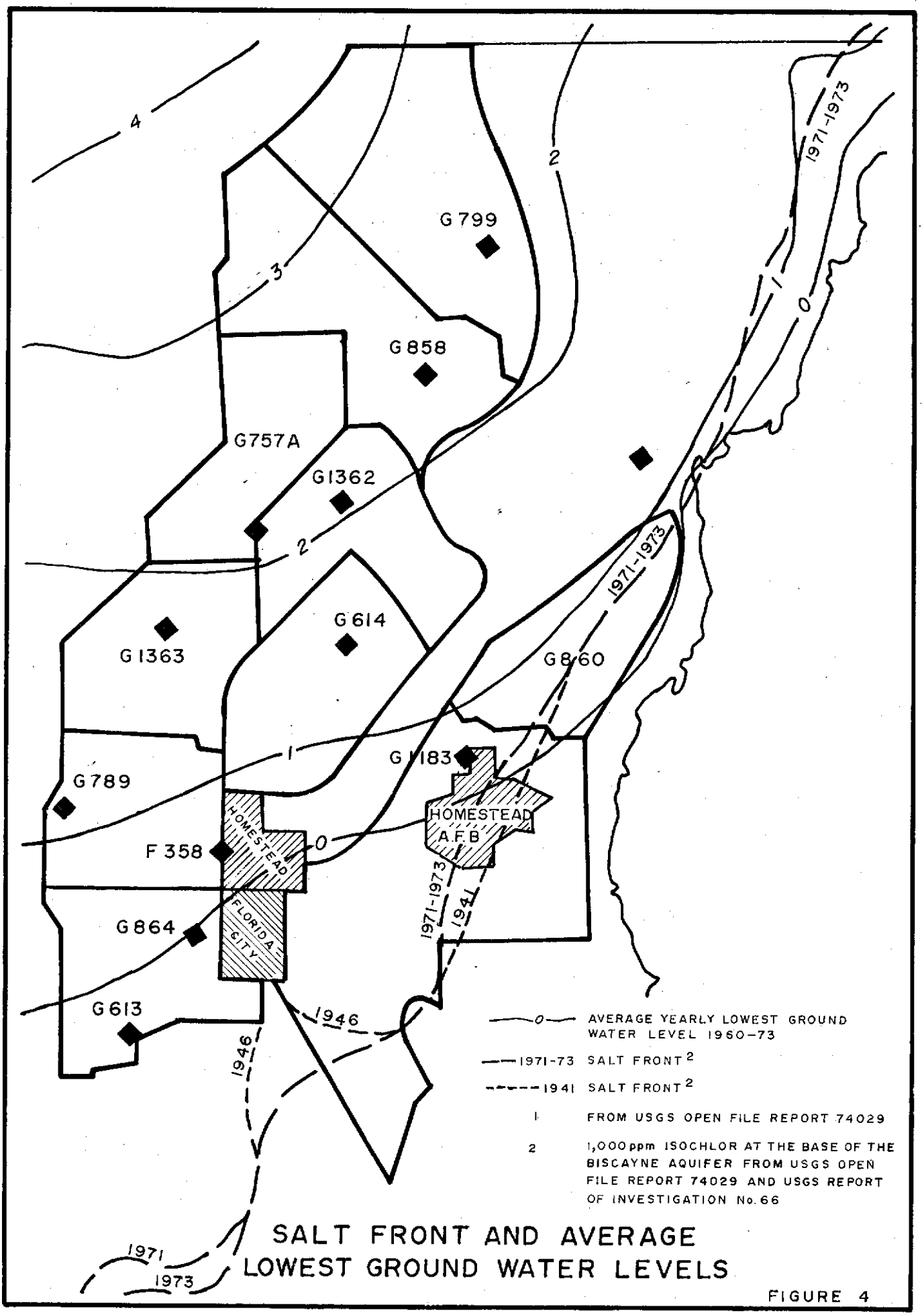

CONSERVATION AREA 3B
TAMIAMI CANAL
CONSERVATION & PRESERVATION AREA
SECONDARY AGRICULTURE (MIXED URBAN)
HIGHLY URBANIZED AREA
PRIMARY TRUCK CROP AREA
WEST GLADES
PRIMARY FRUIT CROP AREA
GLADES
HOMESTEAD
HOMESTEAD A.F.B.
SECONDARY AGRICULTURE (MIXED URBAN)
FLORIDA CITY
EAST
FLORIDA CITY CANAL
POSSIBLE FUTURE AGRICULTURE
CONSERVATION & PRESERVATION
LAND USE

FIGURE 2



MINIMUM GROUND WATER ELEVATIONS

FIGURE 3



SALT FRONT AND AVERAGE LOWEST GROUND WATER LEVELS

FIGURE 4